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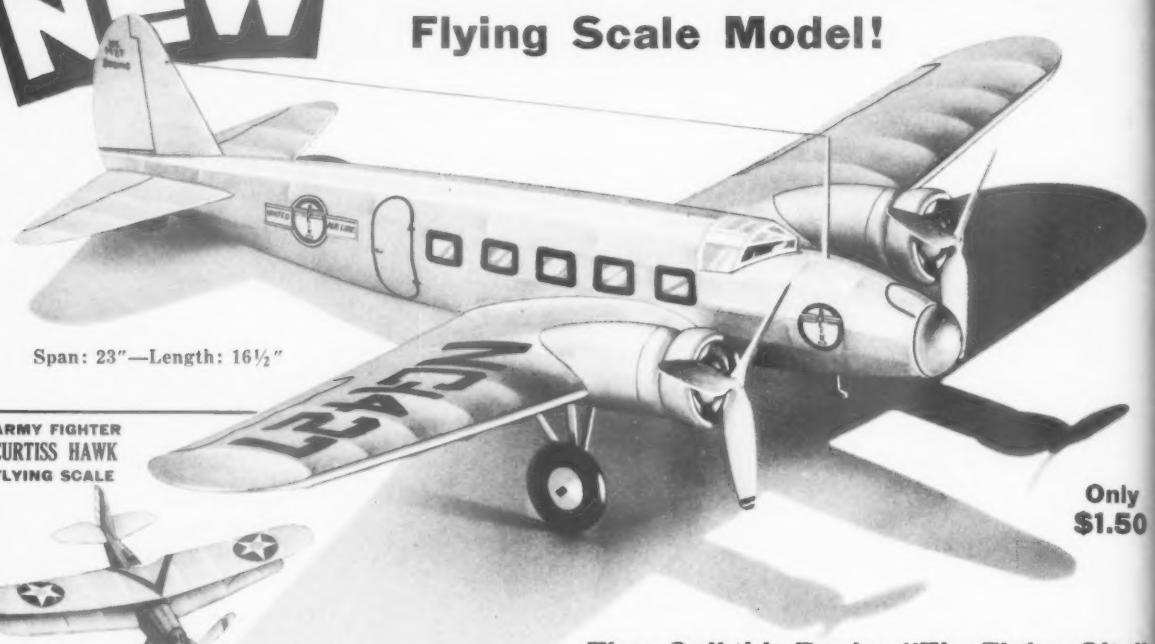

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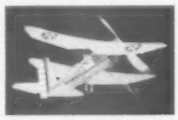

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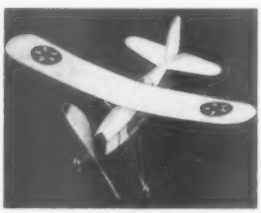

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The NOVEMBER ISSUE

will prove to be a distinct advance over any issue of POPULAR AVIATION yet published. Our readers often comment on the fact that POPULAR AVIATION shows a continual improvement in its editorial matter, arrangement and in its many special features.

In the November Number you will find an excellent article on the New Army Air Corps Landing system, an article both simple and useful, on navigation, descriptions of the latest planes, and a new angle to Practical Lessons in Aviation. There are many other excellent stories, both short and long, scheduled for the November issue including more details on the Boeing 247 for the benefit of model contest entrants.

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An Airy Chat With the Editor

OF ALL the transatlantic flyers who have hopped across the briny during the past few years, Wiley Post makes the greatest appeal to us. He is a real he-man of real accomplishments and with an admirable self-command.

To encircle the globe once is a wonderful achievement, but to make the trip twice, and then with the same plane and engine, is an almost superhuman accomplishment. Here is stamina and endurance personified.

* * *

AND next, comes Lieut. Commander Settle, the premier balloonist who gallantly made an attempt on the stratosphere with a defective balloon. He is not only an acknowledged authority on aerostatics but combines this ability with a sufficient knowledge of scientific instruments and measurements to be awarded the dual honor of piloting the balloon and of taking the observation as well.

* * *

THOSE who believe that the airplane is a deadly weapon should get in touch with the many surviving pilots of the pre-war days. There are sure a big bunch of the old-timers still kicking around, still pert and lively and still capable of penning us a line or calling at this office.

Just as a reminder, we will list a few of the veterans who have contacted us, in some way or other, during the summer. Most of them are still enthusiastic on the subject of aviation and not a few of them are still flying. Walter Brookins and Frank Coffyn, both of the old Wright exhibition team; Orville Wright, himself; Walter Brock of London to Paris fame; Earle Ovington, the first airmail pilot; Ruth Law, early stunt flyer; Jack Vilas of flying boat fame; Matty Laird, the airplane manufacturer; Grover C. Loening, another manufacturer, who with Chance Vought are among our earliest aeronautical engineers; Ed Nelson, all round pilot; Igor Sikorsky, the Russian early bird; Louis Bleriot, France; Tommy Sopwith, England; Mathilda Moisant, early American woman aviator; Bud Morris, Horace Keene; and so on.

* * *

IGOR SIKORSKY will undoubtedly live to a ripe old age, but I doubt whether he will live long enough to forget the party that was pulled off in his honor by the Chicago Chapter of the Early Birds. It was some party, lads—some party.

* * *

IT WOULD be interesting to know just how many readers of P. A. hold a pilot's license—any kind of a license, just so long as it is a license. There is a big bunch of them, that we know from the letters that come into this office, but we'd like to get a fairly close estimate in real figures. Judging from the letters, we'd put the number at about 9,000 but this is simply an estimate. In future communications with this office, as a big favor to us, just jot down the number and grade of your license beneath your signature. This is simply to satisfy our curiosity not to settle a bet.

* * *

OUR ARTICLE on levitation in the last issue stirred up a lot of interest among experimenters who have been working along these lines for some time. It was quite surprising to see the response to this project from our inventors and the many clever arrangements that they have devised to "make the weights all flop in the same direction". In this article, because of the lack of space, I neglected to comment upon the possibility of employing centrifugal force for sustaining a body, but this neglect was not overlooked by several readers who submitted sketches of levitators based upon the centrifugal force developed by rotating bodies. Some of these schemes were so ingenious that they will be published and we hope to see samples of other ideas along this line. Send 'em in.

* * *

JUST as a suggestion to those of our readers who intend submitting ideas on levitation, why not investigate the dynamics of the crank and connecting rod linkage? The fact that the velocity of a piston is different on the instroke and out-stroke should suggest something.

* * *

HERE'S a man with real ideas. He is Mr. Edward Schoof, Lewisburg, Ohio, who proposes a scheme for financing the L. A. A. Whatever you think, or don't think, the proposal is unique.

Why don't you follow the example of our national and state governments and levy a tax on the Barter and Exchange Department? I mean we'll levy a tax of five cents a word for two months or more and direct the funds derived from this method into the L. A. A.

According to my notion, plenty of mazuma will roll in and should be instrumental in rolling up that 500 bucks. True, no members can be added by this method unless someone indulges in expensive book-keeping to keep track of the ads when they amount to a dollar.

Please give my thought a little attention. Surely, the boys will not mind the tax for a few months for a good cause. Ask your readers what they think of it. The only way to present our cause is through such a medium as POPULAR AVIATION, but this goldurned depression makes one dollar look like ten.

Undoubtedly, this would help to raise a fund on the same principle that a chicken dinner raises money for a new pipe-organ, but this is not just what we are after. It is not so much the problem of raising the $500 as it is to find out whether the members can be held down to certain annual fees or dues so that the organization will be insured of continued support. And this is just what the proposed plan does not do. However, Mr. Schoof is to be thanked for his suggestion, for regarded from one standpoint at least, it has its merits.

* * *

ABOUT the only means we have of discovering whether a feature is popular or not with our readers, is to omit it for one or two issues and note whether any kicks or hollers come in concerning the absence of this feature. If we receive no requests for its renewal, then we know that it is a dead issue and the feature or department is dropped for good and all.

With this idea in mind, we have dropped the full page airplane picture for two issues—the big airplane picture that appeared last on the inside rear cover of P. A. We have received some requests for the renewal of this series, but are still in doubt whether there is sufficient interest to renew it. If you want this full size picture continued, write and tell us so.

* * *

WHETHER our Montana correspondent was putting over a "hot

(*Continued on page 231*)

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POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

A MAGAZINE FOR THE PROMOTION OF AMATEUR AVIATION AND PRIVATE FLYING

Volume XIII | OCTOBER, 1933 | Number 4

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POPULAR AVIATION, Volume 13, Number 4, October, 1933. Published monthly by Aeronautical Publications, Inc., at 608 South Dearborn Street, Chicago, U. S. A. William B. Ziff, Publisher; B. G. Davis, Editor; John B. Rathbun, Managing Editor. New York Office, 551 Fifth Avenue, New York City. Subscription $2.50 per year, single copies, 25 cents, foreign postage, $1.00 per year extra. Contributors are especially advised to retain copy of their contributions, which must be accompanied by return postage. All such material will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to revision or changes to meet the requirements of this publication. Payment for copy used will be made at our current rates. Entered as second-class matter, January 24, 1933, at the Post Office, Chicago, Ill., under the act of March 3, 1879. Additional entry, Springfield, Ohio.

HOW TO GET AN

U. S. Army Air Corps Photo.

This nifty biplane is one of the many offered to schools and museums—free—by the Government.

by

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Noted expert on military aeronautics and Air Corps activities.

AN AIRPLANE—*free*—f. o. b. the air-field, where the airplane is last in use! Its equipment listed at a like cost!

Just pay the cost of transportation, comply with a few instructions that cost nothing and that are in no sense a competition, set up the plane, tune up the engine and she's ready to fly! Here comes the catch, however, for Uncle Sam, the donator of wornout and obsolete military air equipment, stipulates that the trade schools, high schools or colleges which are eligible to receive such material shall make no attempt to use it in actual flight.

The primary function of the Army Air Corps is that of national air defense, but one of its secondary functions is the advancement of the knowledge of aeronautics in this country. Information circulars that it publishes, describing specific experiments, are distributed free to members of the aeronautical industry and to schools at which aeronautical engineering courses are given.

A somewhat similar action is taken by the Naval Bureau of Aeronautics and the National Advisory Committee for Aeronautics, an independent government body. Not only the printed word, however, is distributed by the Army Air Corps to advance the country's knowledge of things aeronautical. Actual airplanes, worn out or obsolete, or aero equipment of all kinds, which may serve as life-size specimens of the subjects studied, may be loaned or transferred to following institutions:—

1. Museums, housing a collection of art, of nature and of sciences; open to the public and not operated for profit.

2. Trade schools, not operated for profit.

3. High schools or preparatory schools from which students may enter recognized colleges by examination or "college credits."

4. Recognized colleges or universities having full courses leading to a degree.

Commercial, civic and social organizations, although they may be known as "aero clubs" or "trade schools" do not come within the scope of the schools previously mentioned and are considered ineligible to receive the designated material, according to a statement of the Secretary of War, but the thousands of municipal, county and state schools throughout the land are practically all able to start up classes in aeronautics with this assistance from Uncle Sam.

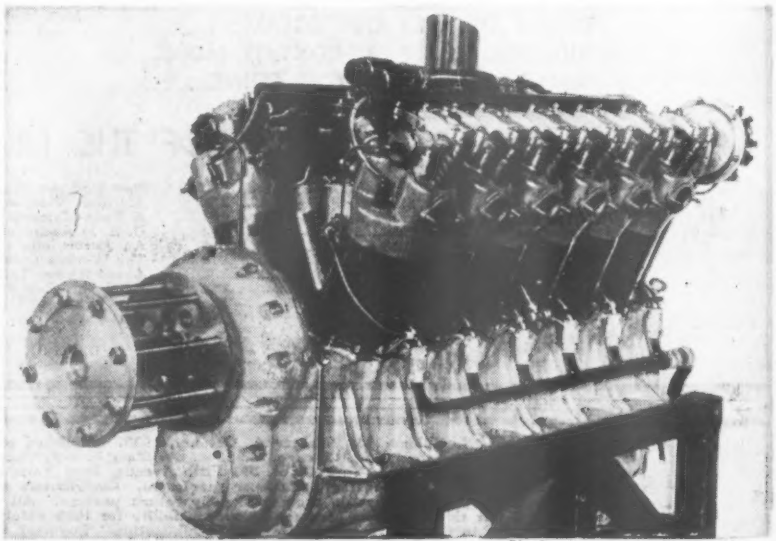
In case of doubt, in the minds of the War Department, as to the eligibility of any institution submitting a request for a loan or transfer of property, they may demand further information as to the institution's standing before making the decision to loan or give the desired equipment.

The Naval Bureau of Aeronautics, in the course of naval air operations, also accumulates a vast quantity of material, and a great deal of this has been distributed in the past where it will do the most good under conditions somewhat similar to those now in force.

The disposition of material, no longer fitted for "active duty," has long been a responsibility of no small degree to the military flying services. Broken up for junk metal it hardly returns the cost of demolishing and sorting. Sold "as is" to second-hand dealers, although with a provision that it may not be used in actual flight, it would be almost impossible for Uncle Sam to trace violations of this clause in the sale contract.

The result would be unfair competition with the legitimate manufacturer if the material in question fell into the hands of those who would take it into the air, sometimes not even knowing its past history and the fact that Uncle Sam had labelled it "not fit to fly." Such action would take advantage not only of an unsuspecting pilot but also of helpless groundlings on the earth below.

In loaning or transferring outright



U. S. Army Air Corps Pho

Here's a 12-cylinder geared type Liberty engine, obsolete for army use but a wonderful engine for student work.

AIRPLANE FREE

THE heads of the U. S. Army Air Corps have wisely decreed that obsolete or worn-out airplanes, engines and aeronautic materials serve a useful purpose when donated to schools, museums or other educational institutions.

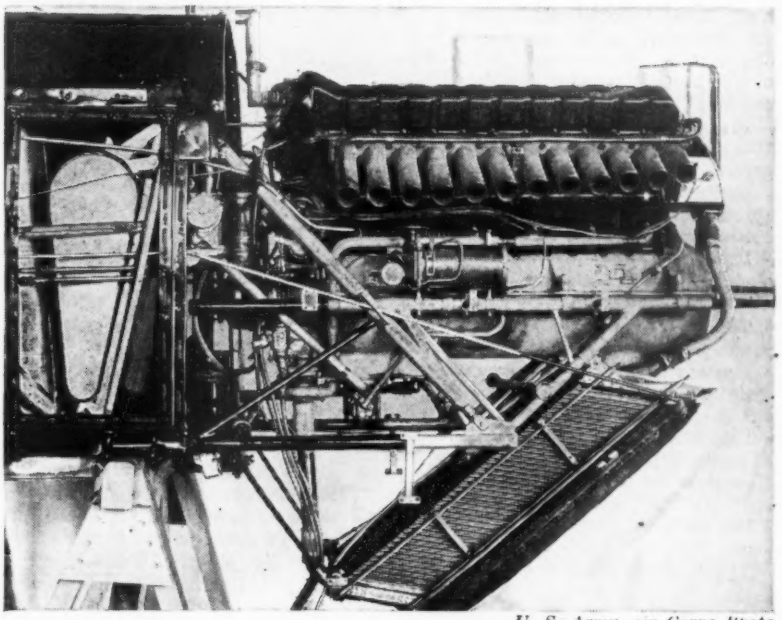
Therefore, these officials are offering obsolete Air Corps material—free—to certain groups of eligibles who wish to use it for student instruction or for exhibition to the public. Their wish is to create aeronautic interest and to promote education.

such equipment to museums or schools Uncle Sam *can* enforce the rule that it will not be used in actual flight, and does so without hesitation, if necessary.

In Army Regulations* published on the subject, the procedure of obtaining such material is explained. From time to time the Chief of the Air Corps submits to the Secretary of War a list of all airplanes, their parts, instruments and engines that have become obsolete or worn beyond economical repair. Through experience with thousands and thousands of engines, and hundreds of each type or model, the Air Corps knows exactly when it will no longer pay to overhaul a certain make or model of engine.

Remember, that to completely overhaul an engine means transportation *to* and from the repair depot and also means tearing down as well as putting together this same engine, which is twice the *labor* of building and transporting a new engine. After a certain number of overhauls, an engine develops wear in so many parts that it costs more to overhaul it than it does to buy a new one. Such engines go on the list.

* *Army Regulations No. 35-6610—For sale by the Superintendent of Documents, Washington, D. C., for 5c the copy.*



U. S. Army Air Corps Photo

This photo of a ship now on the free list, shows how useful it can be made for instruction in the mechanics of the airplane. The students can assemble and dissemble this mass of mechanism, thus gaining first hand knowledge of an airplane.

Many are fit to be torn down, overhauled by students and run up on the test block and have this process repeated many times at the schools to which they are loaned, although they no longer are safe for flying. The same applies to an airplane, which is subject to wear and "fatigue" by continued use. Certain other engines or airplanes may no longer be desirable for military use through having been superseded by superior types.

One of the most striking cases of benefit derived from air equipment by students occurred two years ago at New York University where the War Department at the time maintained an Air Corps unit of the college R. O. T. C. Lieutenant Samuel P. Mills of the Regular Army Air Corps was its instructor. Through this officer's efforts, the R. O. T. C. unit obtained the use of a Douglas basic training plane from Bolling Field, Washington, D. C., for two months.

The airplane was about due for an overhaul at the Air Corps district repair depot at Middletown, Pa., but Lieutenant Mills first flew it from the field at Washington to Van Cortlandt Park, New York City, where he landed it with police permission. There the wings were taken down by the students and the fuselage and detached wings were towed to the University laboratories. For two months the R. O. T. C. cadets dismantled the engine, the airplane and much of the equipment, while the officer gave them lectures, both impromptu and formal, on the phases of the work they were doing.

Even more careful was Lieutenant Mills' supervision of their assembly of engine and airplane, for one day when the work was complete, the airplane was towed back to the park, the wings placed back and re-rigged and the officer flew it away to the repair depot 175 miles away. Mechanics at Middletown reported the ship worn, as expected, but everything in proper adjustment.

To give an idea of the material available for loan to schools or museums the latest list of such worn out equipment published by the Air Corps contained, among other things, the following:

U. S. Army Air Corps Photo

An old training plane, now ready for distribution to schools. Useless to the Army Air Corps, it provides first class student practice in rigging.

XUM

5—Primary Training Airplanes, complete with engine, propeller, etc., but without instruments; 6—Observation training airplanes, without engines or instruments; 65—Liberty engines, 400 h.p.; 20—"Hisso" engines, 180 h.p.; 32—Aircooled, radial engines of various makes; 30—ailerons; 1178—altimeters and altigraphs; 24—Propellers, wooden; 13—Propellers, Micarta; 219—Propellers, metal; 554—Compasses; 136—Fuel level gauges; 138—Fuel pressure gauges; 683—oil pressure gauges; 213—generators; 691—Airspeed indicators; 94—Bank and turn indicators; 433—Liberty tool kits; 238—Dixie magnetos; 29—Electric starters; 75—Hand starters; 973—Tachometers; 4—Electric tachometers.

The Air Corps has been in the flying game a long time and some of the equipment on the list has likewise been waiting a long time for some one to ask to give it a good home and an admiring audience or interested handlers. It is the accumulation of many years. Meantime the storage of such material by Uncle Sam costs the taxpayers a little, so both parties benefit by the loan.

The Chief of the Air Corps can remove any items he sees fit from the list at any time. In general, the property under consideration will be loaned subject to recall. When considered desirable, the material may be transferred outright to the school or museum but this has to be approved by the Secretary of War.

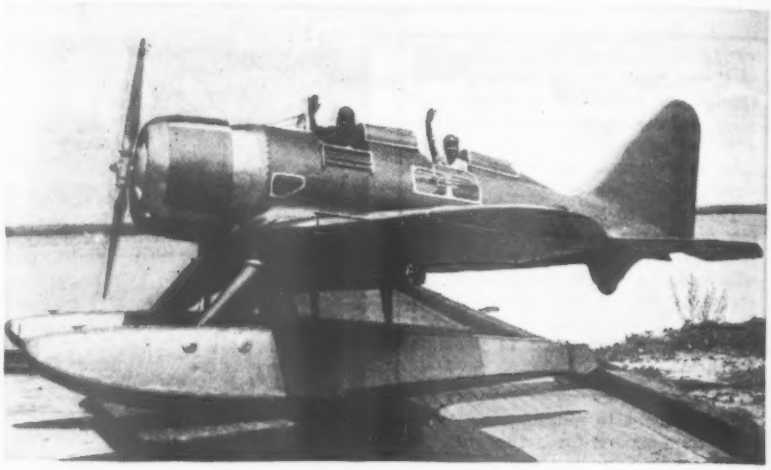
The way it is done, is this. The Executive or corresponding official of the institution writes to the Chief of the Air Corps, Washington, D. C., and requests that such and such items be loaned or given (transferred) to his school or museum, stating that he is willing to pay the cost of packing and transportation and that none of the equipment will be used in actual flying. (He should have previously written in for a list of available equipment.)

Expenses of packing and transportation are determined at the place where the particular items are located. They are usually in one of the following four Air Corps depots—Fairfield, Ohio; Rockwell Field, San Diego, California; Middletown, Pa.; San Antonio, Texas. They may, however, be located at places so distant from the school or museum desiring them that transportation involves considerable expense. The published list gives location of all items. The Executive, or whoever has requested the material, must then pay such charges before the material is shipped to him. Thereafter, once a year, he reports the status and condition of every item he has borrowed, to the Chief of the Air Corps, Materiel Division, Wright Field, Dayton, Ohio.

For a little correspondence and slight packing and shipping costs, he has a well equipped school or museum.

END.

The World's Fastest Amphibian Racer



A view of the de Seversky amphibian monoplane.

THIS newest amphibian, known as the de Seversky SEV-3, is the fastest ship of this type yet built. It was designed by Major Alexander P. de Seversky, a Russian wartime ace.

It is of all-metal construction and is equipped with a 420 h.p. Wright Whirlwind engine. The wing is of the self-supporting cantilever type and is carefully filleted into the sides of the fully streamlined body. It is claimed that it has a top speed of 190 m.p.h.

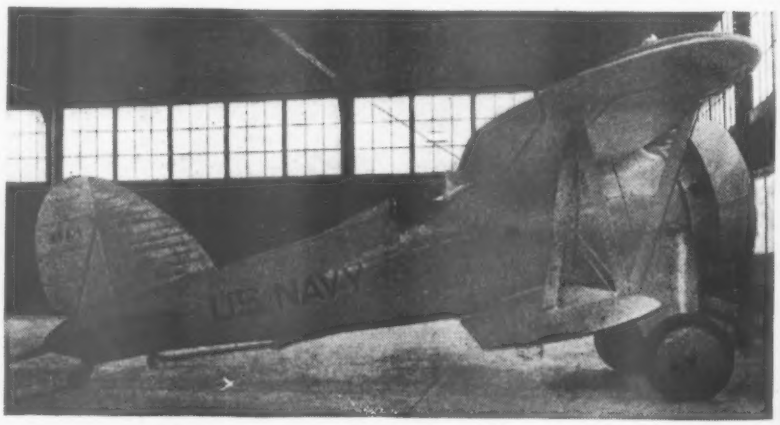
The landing gear is unique. It consists of two pontoons with the wheels arranged to lift up and down in a slot that is opened in the center of the pontoons. Thus, in flight, the wheels can be completely concealed within the floats so that the resistance is far below that of the usual amphibian.

The form of the fuselage is a dirigible hull outline of low fineness ratio that certainly should give a minimum resistance. It seems strange that this type has been overlooked for so long, appearing only once in the Gee-Bee, so far as the writer is aware.

So far as the landing goes, the rig might be said to serve a three-fold purpose. It can make a water landing with the pontoons acting as floats or make a landing on the ground with the wheels down or on the pontoons themselves, the pontoons acting as skids. With the substantial construction of the landing elements, this ship should prove safer than most ships of this type.

The General XFA-1 Shipboard Fighter

HERE'S a side view of the U. S. Navy's latest shipboard fighter, a General Aviation ship, type XFA-1. Our biplane fans will be interested to see that the biplane is still in the running so far as our navy is concerned. No data on its performance has been officially released as yet, nor are we at liberty to include a detailed description of this plane at the present time.



Here's a closeup of the General XFA-1 shipboard fighter.

A Ringside View of the Compton-Piccard Fiasco

by DAVID E. McMILLAN, JR.

Here, the author reviews his thrills at witnessing the attempted stratospheric adventure by the Compton-Piccard group. If nothing else was gained, the makers of the bag got some first-hand information on valve construction.

HOW late did you stay up on the night of August 4th?

It will probably never be known how many hours of precious sleep were lost not only by eye-witnesses but by a vast multitude of radio listeners who followed to a thrilling finish the rapid-fire, breath-taking series of events that preceded and concluded one of the most ambitious flights ever planned.

Ever since the two stratosphere flights of Prof. Auguste Piccard, nebulous plans had been discussed for a new flight to amplify high altitude observations and to break, if possible, Piccard's altitude record of 53,153 feet. Definite action was assured about eight months ago when A Century of Progress, The Chicago Daily News and the National Broadcasting Company, Inc., agreed in the interest of science, and the advertising to be obtained, to collaborate as sponsors for the third balloon flight to the stratosphere.

Scientific and physical requirements were laid down by Dr. Arthur H. Compton and the famous twins, Prof. Auguste and Dr. Jean Piccard. Foremost academic and commercial research organizations were invited to participate in the plans and as a result of their donations to the success of the flight three firms deserve special mention.

The Dow Chemical Company produced an air and water-tight gondola made of an interesting new material called Dowmetal. This metal is recovered by an electrochemical process from brine found underlying central Michigan. It is smelted, cast and rolled into sheets and can be fabricated by oxy-acetylene welding. Dowmetal is the lightest structural metal known, yet strong for its weight which is less than two-thirds that of any other light alloy.

The gondola or car of the balloon is spherical in shape, seven feet in diameter and weighs only 360 pounds—lighter by almost one-third than the ball used by Prof. Piccard last year when he set the present record. Entrance is made by either of two air-tight hatches and light is admitted by several tiny quartz port-holes. Quartz is used instead of glass to insure the admittance of the ultra-violet and infra-red rays which were to be measured at high altitudes.

Construction of the huge envelope was entrusted to the Goodyear-Zeppelin Corporation. Standard practice of design was followed, but in order to reach the heights hoped for, extreme lightness and impermeability were essential, and a high degree of workmanship was made necessary. Approximately one acre of fine rubberized cotton cloth was needed to enclose the 600,000 cubic feet of ultimate volume of the bag. That meant a spherical balloon one-fifth larger than any ever built before.

To the Union Carbide and Carbon Corporation went the job of producing the hydrogen lifting gas as well as the liquid oxygen used in the artificial atmosphere produced within the gondola. It had been calculated that each one-tenth of one per cent impurity in the hydrogen would reduce the maximum ceiling of the balloon by 500 feet. This extreme sensitiveness naturally forbade the use of the safer but heavier helium and necessitated the production in quantity of hydrogen far more pure than any needed commercially.

Scientific and electrical apparatus, radio and photographic equipment and the thousand and one gadgets that were going to make up the composite picture were being designed, built, rejected and rebuilt constantly during the seven months that preparations were under way.

The flight was to have been made by the brothers Piccard, but in the middle of things brother Auguste hied himself to Europe leaving brother Jean to look about for a new scientific observer. Then into the picture stepped Lieutenant-Commander Thomas Greenhow Williams Settle, U. S. N., 38 year old Annapolis graduate, M. S., Harvard University and winner of the 1932 James Gordon Bennett Balloon Race. Veteran of over one hundred balloon flights, Settle was actively engaged as Naval inspector at the Goodyear-Zeppelin works and welcomed this opportunity for participation in a project that he had watched with keen interest.

A few days later Jean Piccard announced his retirement in favor of allowing Settle to make a solo flight and thereby reach a greater altitude with the elimination of the weight of the extra passenger and equipment. This altruistic sacrifice was a distinct compliment to Commander Settle who is one of the few men in the world who combines great piloting ability with the pure scientific knowledge necessary for the purposes of this flight.

Thus was the stage set and the actors assigned their parts. The News had done a fine job of publicizing the show and when the weather man gave his final O.K. on August 4th, it was an interested and informed public that came from miles

Ready to go! The bag of the stratospheric balloon is only partly inflated at ground level so that the gas will be free to expand at high altitudes where the pressure of the air is much reduced.

around to see the performance. Let's join them and see what's going on.

IT'S just after dark—about nine o'clock—as we reach the gates of Soldier's Field on Chicago's lake front just a stone's throw from the "loop."

"No seats left at this gate. All sold out," calls a guard, so we hike around to the far side of the stadium. Once inside we pause to look around and get our bearings. There in the center of the field is the huge ground cloth protecting the precious gas bag now as flat as a pancake, for inflation has not yet started. Just north of the balloon in the open end of the horseshoe is the speaker's platform and stage reserved for officials and guests.

"Guess we can get some seats in the opposite stands. Let's amble over and see what we can see on the way."

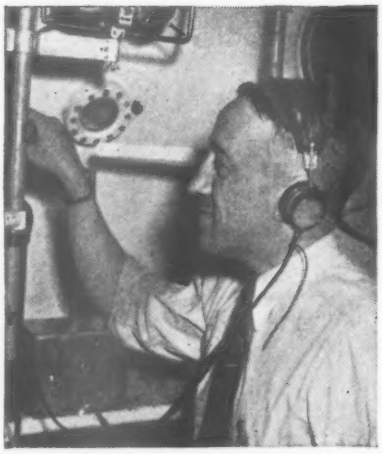
So we climb down into the field and almost fall into the laps of the U. S. Army Band which is blasting a stirring serenade to the assembling crowds until such time as the program commences. A few steps farther on we dodge a detachment of gobs and catch the glimpse of the flashing spurs and sabres of a cavalry troop behind the stage. Yes sir, the armed services are here in all their glory tonight. It's a gala occasion.

Now we're close enough to get a better look at the balloon, but not too close a look because uniformed Naval Reserve guards encircle the bag on the lookout for hobnail-booted yokels who in a few moments of unguarded stepping could undo the work of months. There is not much in the flat fabric itself to interest us except the valve on top which controls the rate of descent. This metal valve casing is about three feet in diameter and six or eight inches high, and with its flat cone top looks very much like an ordinary roof ventilator. We pass on and are stopped almost immediately by a guard.

"No smoking here, and you'll have to go around—I can't let you through this section. They're very strict about this hydrogen."

And when we get around we can understand for here are 50 bright red cylinders each containing 200 cubic feet of pure hydrogen, one of the most explosive gases known. The cylinders are stacked on their sides in five rows, each about six cylinders high. On top of each row and running the length of the row is a tubular metal manifold connected through individual valves and copper tubes to each cylinder. Each manifold through its master valve is connected to a flexible fabric hose which is "siamesed," like a fireman's hose to the final delivery tube leading off across the field to the balloon itself. Thus we follow the arrangements for inflation.

But where's the gondola? It's not on the field so we follow our noses around and finally find it carefully guarded under the stadium. We are impressed by its small size—it seems hardly large enough for one man let



Lieut. Commander Settle trying out the radio set inside of the gondola.

alone the two as originally planned. There seems to be little of interest, however, on the exterior, and from the glimpse of the interior that we see through the open hatch we admit that the maze of apparatus sandwiched inside would probably be beyond our understanding, so we again seek the field and then find seats in the west stand near one of the loud speakers.

THE parade and military maneuvers are drawing to a close and in a few moments a voice comes over the speakers: "My friends——." Startled by this familiarity from a strange voice we consult our program and find that the Master of Ceremonies, Dr. Allen D. Albert, of A Century of Progress staff, is about to introduce Commander Settle. The latter acknowledges a noisy greeting from the crowd and explains that the delay in starting inflation (it is now after ten o'clock) is due to the necessity of waiting for the wind to drop to below five miles per hour. Not only would a wind make the big bag hard to manage on the ground but it might blow it against the 650 foot Sky Ride tower a few hundred feet to the south.

The inflation process viewed from the top of the "Sky Ride," Century of Progress.

Recalling the Beaufort scale we make a mental note to watch the flags bordering the field as they should cease fluttering at about five miles per hour. So we sit quietly and listen to a series of speeches by various and sundry guests and learn that among the aims of the expedition, two of the most important are the measurement of the cosmic ray and its relationship, if any, to radio waves, and the photographing of the earth from such altitude as to show, if possible, its curvature.

In another half hour the flags are motionless on their poles and Commander Settle gives authority to General Frank Parker to start the inflation. As the first valve is opened the inert fabric hose takes on life and like an infuriated snake hisses and writhes under the impact of the expanding gas within it. As more valves are opened the hiss amplifies to a high pitched roar that drowns out even the crowd's excited murmuring and the blare of the band.

A little bubble of gas like a blister raises the flat surface of the bag and in a few minutes the roar of the gas subsides. The first cylinders are exhausted and the ground crew is at work transferring the manifold leads to fresh cylinders. A slow job but a fascinating one and the crowd watches spell-bound as the activity in the field increases. The ground crew gets its last minute instructions as more gas is turned on, and with a mighty lurch one side of the balloon lifts itself and the bag assumes a ludicrous shape like a drunken toadstool.

Now the ground crew of Naval Reservists get to work in earnest. Each unit of two men encircling the bag handles one of the hold-down ropes which is looped through a fillet near the top of the bag and then snubbed around the anchored stakes. These ropes will have to hold down a lifting force of 8,800 pounds after inflation is completed and before the gondola and ballast are attached.

More speeches, more music, more hydrogen and the hands of our watch gallop around to one o'clock before the greedy bag has had its fill of 125,000 cubic feet of gas. The remaining 475,000 cubic feet of bag volume allows for expansion as the atmospheric pressure decreases with the increase in altitude. Through innumerable grotesque shapes the bag emerges as a gigantic inverted pear swaying and tugging at its lines.

Now comes the delicate job of removing the feed hose and closing the appendix. While this is going on the gondola is wheeled on to the field. With a bottle of liquid oxygen Mrs. Rufus C. Dawes christens it "A Century of Progress." Meanwhile other workmen have been connecting the shroud lines from the lower part of the bag to the

(*Continued on page* 266)

Wiley Post—Circumnavigator

by JAMES FARBER

An intimate biography of a most amazing character, who is possessed of exceptional grit, determination and physical endurance. How the chicken farmer became the world's premier pilot.

WILEY POST is the personification of the barnstormer's dream come true. He is the embodiment of everything the young glider pilot, the ambitious kiwi or the home-built plane pilot hopes to be.

And yet—what a long string of tough breaks pave the path leading to the intrepid Post's position among America's premier aces! "You already know, of course, from seeing his pictures, that he has lost his left eye. You know, too, that he circled the globe twice under the same handicap.

That hard break alone would have discouraged many a man. Post, however, was only out of the hospital a matter of hours before he was again at the controls of a ship. Not to learn, once and for all, of his possible debarment from flying—but to learn just to what extent he would be handicapped.

He knew he wasn't through flying. He didn't give that more than a passing thought. He was only resolved how to make up for his loss and carry on! You could understand this trait in the man were you to sit down for a chat with him.

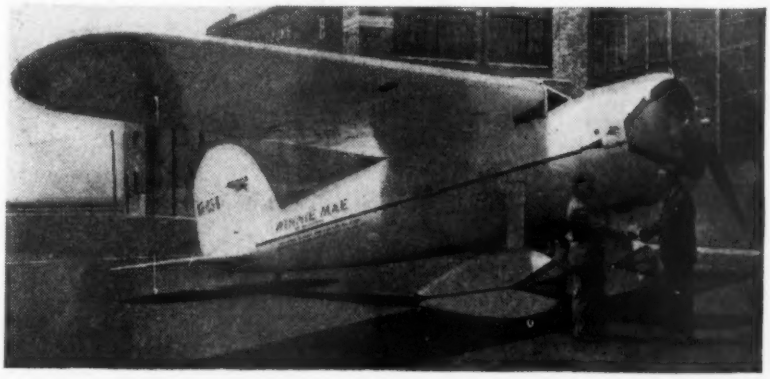
He flashes no winning smile on you, as Lindbergh does occasionally. He is quiet and talks quietly and convincingly. Unfortunately, perhaps, for publicity purposes, he isn't a dashing figure to topple over your imagination into a nose-dive of joy at hobnobbing with one of our great flyers.

He doesn't have that slender streamlined figure of many of our much photographed flyers. He is chunky—a man of iron muscles and sturdy build acquired after long hard years in the Oklahoma oil fields.

And, as he gives you something of his biography in a spasmodic sort of way, you get the idea that many of the things he did in by-gone years were the result of spasmodic quick decisions. One suspects, however, that as suddenly as the decisions were made, they were made the fruit of many mental processes.

Wiley Post used to raise chickens on his boyhood farm in Texas. A hard worker and a prudent saver, he got together his railroad fare to Kansas City, Mo., and took a last look at the chickens which had laid enough eggs to get him started on a great flying career. He precipitately departed from the farm. Destination—an auto mechanics course in K. C.

He needed more money, so he went where money could be made—the Oklahoma oil fields.



A view of the reconstructed Winnie Mae with Wiley Post (left) standing beside her. This gallant old ship, and its engine, have circled the world twice—an outstanding record.

He still had the same idea of flying he had when he joined the aviation section of the Signal Corps during the war by misrepresenting his age. His triumph was short-lived. The deception was uncovered and Wiley found himself out of the army, but still eligible for the S. A. T. C. which he joined and served "for the duration"—with Philip LaFollette, later governor of Wisconsin, as his C. O.

Working at Holdenville, Okla., Post heard of an airplane coming to town to regale the inhabitants with its bags of tricks—among which was to be a parachute jump.

The professional jumper, having been injured and laid up in a nearby hospital, Post threw aside his tools, interviewed Burwell Tibbs and Tip Schier, the pilots, and persuaded them to let him make the advertised jump. The agreement was reached when Post said he was willing to take $25 instead of the usual $50 for the leap.

He then joined up with these barnstormers and made 91 leaps, but it remained for the oil fields to deal him his most disheartening blow.

When the trio broke up in 1926, Wiley went back to the oil fields. After two days on the job, he was hammering a link pin into a rotary chain of a rigging job when a piece of the incandescent metal struck the pupil of his eye. In the Oklahoma City hospital, every effort was made to save the orbit but removal became imperative.

It was a terrible means of achieving his purpose but it did just that—Post had returned to Oklahoma for the express purpose of earning enough money to buy himself a ship. And the $1,800 he received as industrial compensation for the loss of his eye provided the means.

With one solo flight to his credit, he went in search of a ship. He found one—an old Canuck trainer. It cost him close to $600 to buy it and get it in shape. And after a successful barnstorming career, he sold it for $700. He says he got 700 hours and a bride out of it.

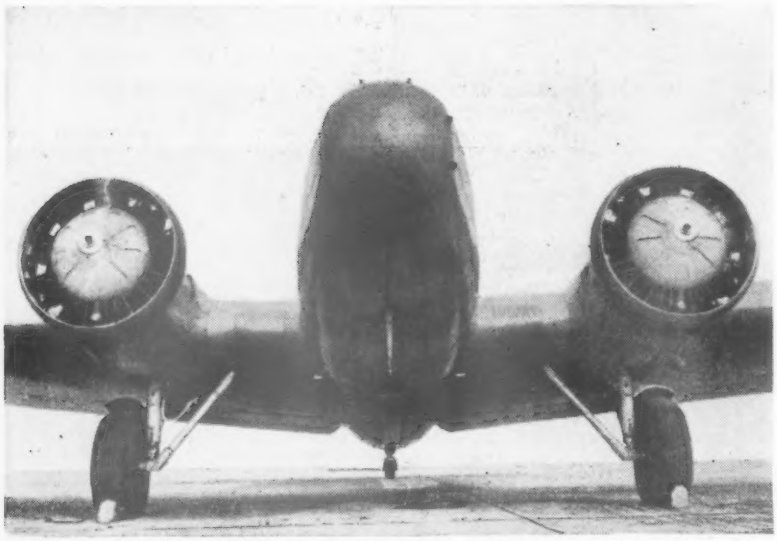
Mrs. Wiley Post, who followed her husband's career so anxiously and with such justifiable pride during his recent exploit, was Miss Mae Laine when she climbed aboard Wiley's OX-5 powered Canuck. This ship played so many tricks on its pilot that he was obliged to make an unscheduled landing near Graham, Okla. Wiley then located a Justice of the Peace. He proposed, was accepted and the knot was tied.

A man of responsibilities now, Wiley turned his attention from the uncertainties of trouping and barnstorming to become a private pilot for F. C. Hall, millionaire Oklahoma oil man. This was in June, 1928. Hall bought a plane and christened it the Winnie Mae, a name that was later bestowed on the Lockheed-Vega which was to carry Post and his navigator, Harold Gatty, around the world.

Wiley's first big break—if you want to call a carefully planned assault on speed marks as a "break"—came when he won the 1930 Los Angeles-Chicago speed race. He nosed out some crack pilots of the day—the late Billy Brock, Col. Roscoe Turner, Art Goebel and Lee Schoenhair. Not long after, with the financial aid of his friend and patron, F. C. Hall, Post and Gatty hopped off for a world-girdling attempt.

XUM

Sensational Prizes Offered



This is the giant Boeing Wasp-motored plane that will carry the first three contest winners for their tour on United Air Lines. A wonderful experience for the lucky contestants.

FAR surpassing all previous model contests, with bigger and more costly prizes for the winners, the coming POPULAR AVIATION Second Annual International Model Airplane Contest will be the center of interest and the outstanding attraction for model builders in the United States, Canada and Mexico.

You, as well as the other readers of POPULAR AVIATION will be truly astounded at the nature and value of the prizes being offered to the winners of this most elaborate of model contests. Each prize has been so selected that its winning is the attainment of the model builder's greatest ambition, things that you have long desired but which have proved to be out of your reach.

All this has been made possible for our readers by the cooperation of the Boeing Airplane Co. and United Air Lines with the staff of POPULAR AVIATION. A contest of such magnitude would have been impossible had it not been for the interest and assistance of these three great aeronautical institutions. And so, the Boeing Airplane Co., United Air Lines and POPULAR AVIATION, joint sponsors of the contest, urge you to put forward your best efforts toward winning one of these really worth while prizes.

Just as an example, the first prize consists of a 6,000 mile air trip to any one of three points that you may select. You can take a trip on one of the new Boeing "247" monoplane transports to the Boeing manufacturing plant at Seattle, Wash., where you will be given a two day stay over with all of your expenses paid. Or else you can take a trip to the Boeing School of Aeronautics at Oakland, Calif., with a two-day vacation, free of charge, where you will be given a two day introductory course in flying. If you live on the Pacific Coast, the first prize will entitle you to a New York trip in one of the luxrious three-mile-per-minute Boeing "247" planes, with a two day stay in New York all expenses paid.

Imagine yourself being whirled through the air via United Air Lines in one of the most modern planes, to the Boeing School where you will be given every attention and where all operations will be carefully explained. This will be an education in itself. And there is the pleasure of visiting those great cities that you have always longed to see with all expenses paid.

Winners of the 4th, 5th, 6th and 7th prizes will be awarded this beautiful 20-inch silver replica model of the Boeing "247" monoplane.

20 Prizes Offered

1st. Prize. A 6,000 mile trip on United Air Lines in one of the new Boeing "247" low-wing twin-motored monoplanes and a two-day vacation with all expenses paid. Choice of Seattle, Oakland—San Francisco, or New York City and return.

2nd. Prize. A 3,000 mile trip on United Air Lines in one of the Boeing "247" monoplanes and a two-day vacation with all expenses paid.

3rd. Prize. A 2,000 mile trip on United Air Lines in one of the Boeing "247" monoplanes and a one-day vacation with all expenses paid.

4th-5th-6th-7th Prizes. Beautiful 20 inch silver scale trophy model of the Boeing "247" monoplane mounted on a pedestal.

8th-9th-10th Prizes. Authorized inspection tour of the nearest United Air Lines port. Here, the pilot in charge will explain all of the inner workings of the Boeing "247" monoplane.

11th to 20th Prizes. A three-year subscription to POPULAR AVIATION.

SPECIAL NOTICE

All prize winners will be given a gold medal of honor as a permanent testimonial of their ability as model builders.

Then, there is the second prize of a 3,000 mile trip on United Air Lines in the Boeing "247" which will be a revelation to you. You are free to select your own route and destination, providing that the total milage, out and back, does not exceed the distances given. The third prize limits the total distance, out and back, to 2,000 miles which is a mighty fine cruise and which would prove very costly were the trip to be paid out of your own pocket. And, in addition, you will have a one-day stay-over with either prize that will be free of expense to you.

When we say, "free of expense", we mean just that. You will be picked up by a car at your own home, and taken to the nearest United Air Lines port. If you live at some distance from the nearest airport, you will be taken to the airport by rail with your fare and all other expenses paid. From the time that you leave your home until the time that you are returned, you will not spend one cent of your own money for your transportation, food or lodging.

Our fourth, fifth, sixth and seventh prizes consist of a beautiful 20 inch silver scale model of the Boeing "247" mounted like a trophy on a silver column and pedestal. This is a beautiful ornament for your study or living room which will long remind you of your victory in this contest and as your ability as a model builder. This

In P. A. Model Contest

How to Enter the Contest

1. *Build a model of the Boeing "247." No other model will do.*
2. *When completed take several photographs of your model so that we can see several sides of it. Good clear snap-shots will do.*
3. *Paste the accompanying coupon, or an accurate facsimile of this coupon, on the back of each photo for identification, filling out the required data.*
4. *Send the photos to* POPULAR AVIATION, *Model Contest,* 608 *S. Dearborn St., Chicago, Ill.*
5. *DO NOT SEND THE MODEL UNTIL WE ASK FOR IT*
6. *Start your model early so that you will not be rushed at the end of the time. Carelessness may spoil your chances of winning a prize.*
7. *December* 15, 1933, *is the last day on which photographs may be mailed.*

Every comfort and even luxury is provided in the magnificent new Boeing "247" monoplanes. Picture yourself, as one of the winners in this contest, riding for thousands of miles in one of these superb planes.

trophy is wired so that it will light up in beautiful style.

The remaining ten prizes are both practicable and enjoyable. They consist of a three-year subscription to POPULAR AVIATION, enabling you to enjoy your favorite aeronautical publication for a full three years without cost to you.

In addition to these twenty prizes, every one of the twenty winners will receive a beautiful gold medal of honor as a permanent trophy of this contest. This special medal with a life-like view of the Boeing "247" embossed upon the face is alone, a beautiful award that you will be proud to show to your friends. This testimonial of your ability wins recognition for you as a model builder of the first rank.

And now as to the method of entering the contest, which is very easy and simple. In the first place it is absolutely free, no charges of any kind being attached to the entry model, nor are there any irksome regulations or restrictions. It is really much easier to build a model for this contest than it was last year because there is only one type of model and we furnish you with the complete plans and instructions for building this model.

In this and succeeding issues you will find the scale drawings, instructions and photographs of the various details of the full size Boeing "247" low-wing Wasp powered monoplane transport which you are to produce in model form. The fact that you will find all of the information that you require within the pages of POPULAR AVIATION will greatly simplify your work and save you time and worry.

You can build this model to any size you wish so long as it is to scale or in the proper proportions, and it can be made from raw materials or from a kit, just as you wish. Again, it can be either a flying or a non-flying model but it should be understood that there will be no separate awards for these two classes nor will there be any special award for flying performance. It is just a matter of whether you wish to enter a flying or a non-flying model or both.

Because of the simplicity of its outlines and the absence of complicated bracing, you will find the Boeing "247" comparatively easy to build. It is much simpler than the majority of the military planes that you have built but still it will require care.

In this contest, the most essential points for winning a prize are neat workmanship and accuracy. In other words, your model must be, so far as possible, a replica of the full size plane on a small scale. It is our purpose, in giving this contest, to develop constructional ability and workmanship, just as in our contest of last year. As to the amount of detail, we will leave that to you.

Remember, that this contest is open to all model builders in the United States, Canada and Mexico. There are no age limits, we do not care whether your age is six or sixty. It is not even necessary to be a subscriber. Anyone who can build a good model is eligible for entering the contest. By "lifting the lid" in this manner, we stand a better chance of getting high grade models than by leveling unreasonable restrictions on the entrants.

After your model is complete, take several photographs of it from several

Your name and address must be on the back of every photograph submitted in this contest. This coupon, or a facsimile of it, should be pasted on the back of each photograph.

POPULAR AVIATION SECOND INTERNATIONAL

MODEL AIRPLANE CONTEST

608 South Dearborn St., Chicago, Ill.

Please enter this photograph of my competing model in your contest. My entry is an accurate model of the Boeing "270."

☐ Flying model. ☐ Non-Flying model.

Name .....

Address .....

City..... State.....

viewpoints. Clear snap-shots are plenty good enough for the purpose although, of course, there is no regulation against commercial photos. The greater the number of views, the better we can judge the model and for this reason we suggest that there should be at least three views of each model entered.

Send in these photographs, with a coupon or an accurate facsimile of the coupon pasted on the back of *each* photograph. Mail the photos to us, but DO NOT SEND THE MODEL until we ask you for it. We will select 20 preliminary winners by an examination of the photographs, and then will send for the 20 winners for final judging. From our experience in the last contest, we found this method very satisfactory and it avoided much confusion and loss of models. If every entrant were to send in his model without first sending the photos, we would be swamped.

While the use of the coupon is not imperative, yet this printed form is easier for the judges to handle. In any event, print your name and address, as longhand signatures are frequently very difficult to decipher. Neglect in giving your name and complete address, will of course, render your entry void.

Just as a means of simplifying the matters so far explained in this announcement, let us assume that the winner of the first prize is John Doe, and that the winner of the second prize is Richard Roe. We will follow the activities of these boys from the time that they start on the model to the time that they arrive home after their journey over United Air Lines. We will assume, for example, that John Doe lives in New York City, while Richard Roe resides in Rockford, Ill. The curtain now rises on their activities, which up to the choice of the route, are identical.

John Doe, noting the announcement of the model contest in POPULAR AVIATION, decides to enter the contest, becoming as after events prove, a champion builder. He starts in, using the drawings and photographs of the Boeing "247" in this magazine as his guide, and after some time engaged in careful work, the model is completed.

With his kodak, John takes several snap-shots of the job, pastes the coupon on one photo and facsimiles on the others, fills them out and sends them to POPULAR AVIATION, Model Contest Dept., 608 S. Dearborn St., Chicago, Ill. John Doe is a strong believer in the theory that it pays to get his photographs in at the earliest possible moment so as to avoid the big rush at the closing time of the contest which is December 15, 1933. This is also the course pursued by Richard Roe who has his job completed and the photos in the hands of the judges on October 15.

Finally, December 15, arrives and the judges begin their long hard job of examining the mass of photographs before them. It does not take long for their experienced eyes to note that two of the models are of outstanding excellence, those of John Doe and Richard Roe. Finally, their models and eighteen others are picked out and letters are sent to these twenty boys, requesting them to send the models to the offices of POPULAR AVIATION.

Now comes a problem that neither of the boys have encountered before—the difficult problem of packing a model airplane so that it will not be smashed to smithereens before its arrival in Chicago. After devoting a considerable amount of thought to the subject, John Doe selects a strong wooden box, and after driving nails at various points around the interior of the box, carefully suspends the model from the nails so that it does not touch the sides of the box at any point. The strings act as shock-absorbers and save the model from destructive vibration. John knows that packing a model in saw-dust or excelsior, or packing it tight into a crate, is certain destruction.

Richard Roe, choosing another good method, wires his model securely to a board and then, after placing a thick pad between the bottom of this board and the bottom of the box, wires the board to the box. This again, avoids shock and vibration from being transmitted to the model. These two methods, both boys knew, were the most successful in last year's contest. After carefully closing the box with screws (not nails), the boxes were carefully addressed to POPULAR AVIATION and were sent, charges prepaid.

On opening the boxes at Chicago, the judges found that the models both came through without breakage, which saved a lot of time and trouble for both the judges and the contestants. A careful inspection of all twenty models after many comparisons were made and several arguments had taken place, resulted in first prize being awarded to John Doe while the second prize went to Richard Roe. They were notified immediately of their victory and were asked to carefully study the routes and destinations that they preferred and to state when they preferred to make their pilgrimage.

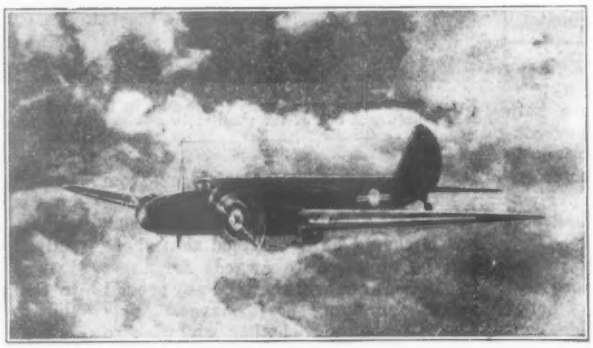
Of course, John and Richard were overjoyed at their good fortune and started making their plans. John Doe was attending Harvard at this time so he preferred to postpone his trip until the following holiday vacation, in January. Richard Roe was working and could not leave his job until vacation could not leave his job until June. These postponements were acceptable for offer holds for one year from time of award.

After some careful calculations as to time and preference, John Doe decided that a visit to the Boeing Airplane Co., Seattle, Wash., made the greatest appeal to him for he desired to get an inside view of a great airplane plant in operation. If John lived in Cleveland instead of New York, his trip to Seattle would have been approximately 600 miles shorter since the first prize is not necessarily a coast-to-coast trip (unless the winner lives on Atlantic or Pacific Coast) but offers a trip to Seattle, Oakland, or New York at the winner's option.

John scanned the time-tables and found that the twin-engined Boeing monoplane left on Trip No. 5 at 4:00 p.m., which just suited his convenience. He advised POPULAR AVIATION of the route and time that he wished to leave.

Promptly at 2:30 p.m., January 2, the pick-up car called for him at his

(*Concluded on page* 268)



The Boeing "247" flying above the clouds on United Air Lines at a speed of about three miles per minute. This ship, the latest product of the Boeing shops, is powered with two Wasp engines.

Rules Governing Contest

1. *This model contest is open to all model builders in the United States, Canada and Mexico. There are no entry fees, no age limit nor is it necessary for you to be a subscriber to* POPULAR AVIATION.
2. *Either flying scale models or non-flying scale models can be entered.*
3. *Any size of scale model will be acceptable so long as it is to scale or in the correct proportion. Each contestant may submit as his entry more than one model.*
4. *Only one type of model will be considered, a model of the twin-motored low-wing Boeing "247" transport. Models of other airplanes are not acceptable.*
5. *Awards or prizes will be based upon the excellence of the workmanship displayed, upon the finish and upon general accuracy.*
6. *The preliminary judgment of the models will be from photographs. Twenty model planes will be invited to Chicago for personal inspection and final eliminations.*
7. *DO NOT SEND YOUR MODEL UNTIL WE ASK FOR IT.*
8. *The dead-line for submitting photographs of your model is December 15, 1933. No photos will be inspected that bear a postmark later than this date.*

Major Prizes in Contest

XUM

Major Prizes in Contest

STUDY the map and photos on this page with care. Which trip would you prefer if you were one of the lucky winners of the first three major prizes in POPULAR AVIATION'S model contest? Free trips of 6,000, 3,000 and 2,000 miles, respectively, are offered for the first, second and third prizes in this model contest.

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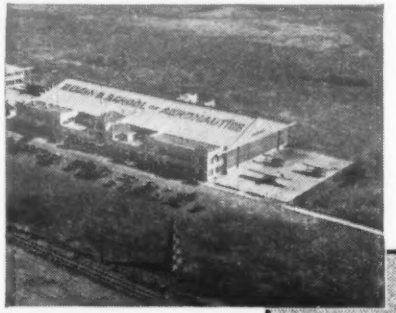
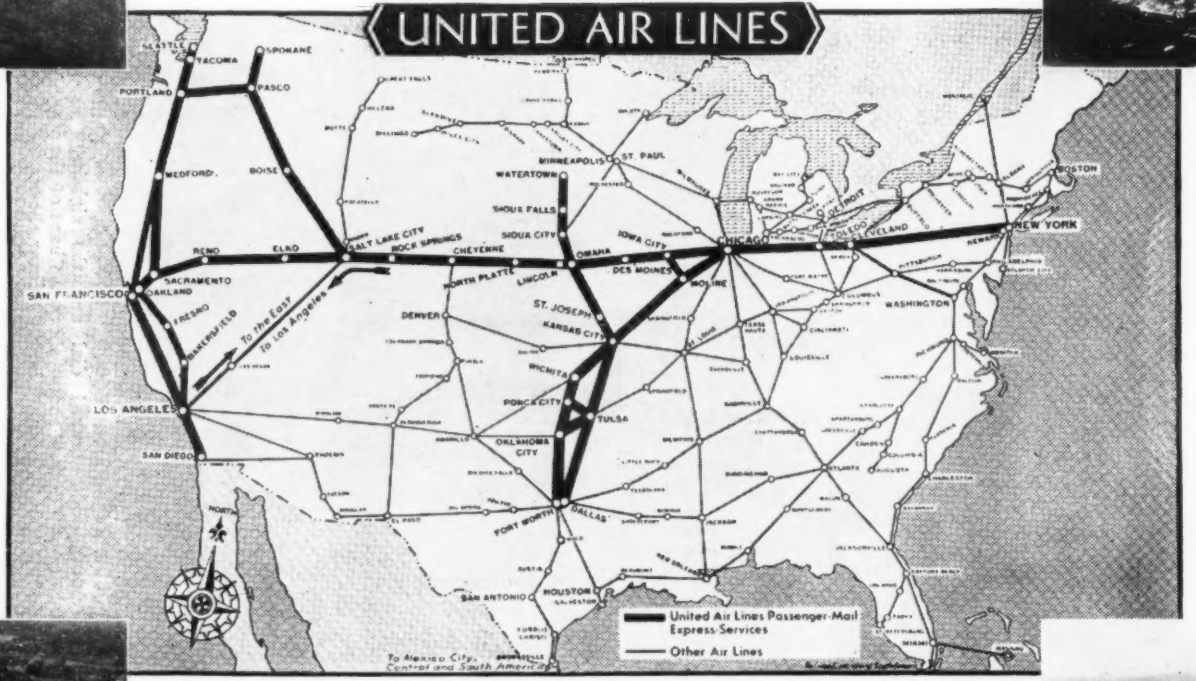
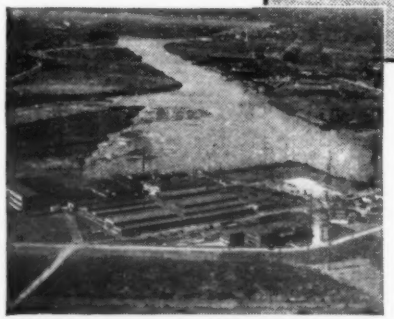


A bird's-eye view of the Boeing School of Aeronautics, Oakland, Cal., one of America's most completely equipped and modern schools of flying. A visit to this school will prove of great interest and benefit to one of our prize winners who will elect to visit this terminal.

A bird's-eye view of New York City which offers many attractions to visitors and which is on the itinerary of the trip offered in this contest. All of your expenses will be paid.



This is the mammoth plant of the Boeing Airplane Co., Seattle, Wash., which will be inspected by one of the lucky winners of P. A.'s model contest. Many types of airplanes are built here, both commercial and military.



Here is one of the low-wing twin-motored Boeing planes on which the prize winners will take their trips. It travels at a speed of three miles per minute and is luxuriously outfitted and equipped.

This map shows the routes described in the accompanying article, the route of United Air Lines being indicated by the heavy black lines. The map is scaled approximately to 525 miles per inch so that you can make a rough estimate of the distances by measuring the map on this basis.

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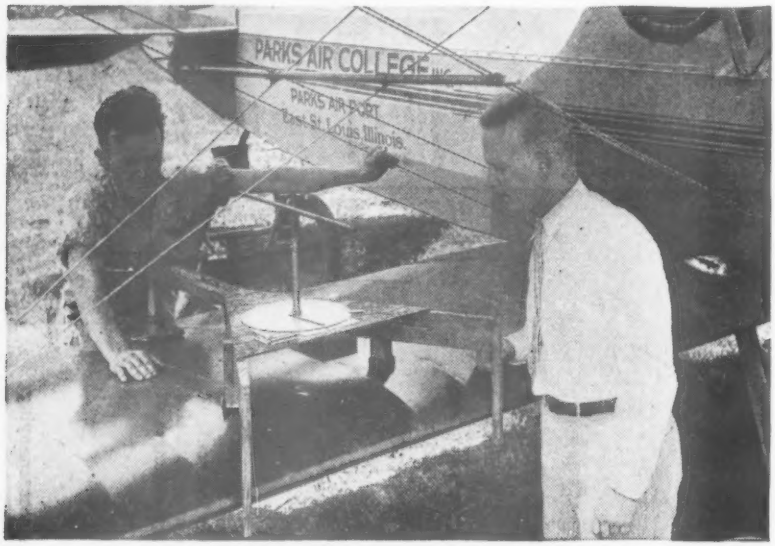
For full information regarding these free air tours, read the accompanying article starting on page 226 and also the model article on page 255.

Parks Air College Develops New Instrument



This is the way in which the new compass compensator is applied for taking a check-up on the compass.

A NEW and unique device for the accurate checking and compensation of compasses has been developed by Norman Anderson, Chief of the Executive and Transport Pilots' Ground Schools, Parks Air College. The new device cuts down the time required from approximately three hours to less than fifteen minutes.

The instrument is both light and portable. It is mounted on the wing or any nearly level portion of the airplane which has a straight edge at a known angle to the fore-and-aft line of the ship. The leading edge of the wing serves perfectly. By use of the instrument, the compass can be compensated and checked at 30° stations very easily and quickly.

The principle of the instrument is similar to the pelorus of seagoing craft. It has a sighting piece 24 inches long, mounted on a vertical shaft so that the two move together. At a lower station on the shaft is attached a pointer which moves over a rotatable graduated disc, which is graduated in 30° units from 0° to 330° clockwise and counter-clockwise. An index mounted on the frame base is graduated into degree units to permit any degree setting of the disc.

The method of using the instrument is extremely simple. A convenient corner of the airport or field (at least 100 feet from the nearest steel structure) is selected. Here a stake is driven.

At a certain time daily the sun bears true East. The operator observes the sun with the instrument and moves the sighting piece, holding the same bearing to find a ground object which is also due East. If variation is East, he selects a magnetic bearing point South of the true by the angle of variation. A West error is corrected in the opposite way. The operator makes a record of this point, which is due East magnetic, and uses it for reference.

Now the bearing of several prominent objects in the vicinity may be determined for use in case one is obscured. The objects should be at least 2000 feet distant from the stake.

The rotable disc is set to 90° and the sighting pointer to zero. In this position the ship, with its tail up on a dolly, is pulled around until the object selected comes into the sights. The instrument should be over the stake, but a variation of 10 feet will not introduce any appreciable error.

In this position, the compass is set to zero by the compensator. The pointer is set to 90°, the ship swung until the selected object comes into the sights and the compass set to East. The rest of the corrections are carried through in the same manner.

The great simplicity of this device will be seen from the accompanying photograph which shows it being applied to the leading edge of a lower biplane wing. Two of the legs engage with the leading edge, thus squaring the compensator with the ship while the third and rear leg acts simply as a support.

The round dial and the sighting piece are shown above the base of the instrument, while the pointer shows as a black line on the dial. To those of our readers who have ever tried or seen the old method of orienting a ship, this will appear as a remarkably easy operation.

This instrument is accurate to ½ degree and tremendously simplifies and shortens the job of compensation. The instrument has been in use now for over two months by Parks Air College and by the Parks Approved Repair Station, with 100% perfect results.

Airplanes in Gold Fields

WHEN gold was discovered in British New Guinea four years ago, the government was faced with a knotty problem.

The gold field was located 40 miles inland from Huon Gulf, one of the few sheltered bays along the British side of this island. To lay a railroad to the field would have meant a prohibitive expense and endless delay, for it would have meant cutting through the densest sort of solid jungle and crossing three mountain ranges.

So the airplane came to the rescue. Now there is a thriving city at the gold mines, which are worked by the most modern of machinery all of it brought to the scene by airplane. The only means of reaching or leaving the mines is by plane.

In a year and a half, three all-metal freight planes, powered with American-made Hornet motors, carried across jungle and mountain range a weird variety of machinery and other articles, including two complete dredges weighing 1,200 tons each (dismantled and shipped piece by piece); a 4,000-kilowatt hydro-electric plant, complete machine shop equipment, boilers, air compressors, steam engines, two complete sawmills, caterpillar tractors, automobiles and road-building machinery.

The total weight of all this was more than 40,000 tons. One plane made 458 trips, another 462 and the third 287.

One problem has been the construction of suitable landing fields. On the soggy little fields available, the grass grows two inches a day, and a corps of black boys is kept continually busy with lawnmowers.

European Airport Lighting

EUROPEAN nations, particularly Germany, are far behind the United States when it comes to night flying.

Recently, a night route was started between Cologne and Frankfort, Germany. The Cologne field is fairly well lighted by a number of electric lights which throw red beams upward to mark the contours of the airport. A searchlight throwing a white beam marks the airport in foggy weather as in most of the small fields in the U. S. A.

But the lighting equipment at Frankfort is not even as elaborate. When the roar of a plane is heard there, an automobile with number of ordinary kerosene or oil storm lamps attached to hooks is run from one side of the field to the other against the wind and the lights are placed in a line on the field.

The first lamps, placed in the danger zone near the edge of the field, are fitted with red glass, while the following ones to the end of the line are ordinary white glass.

When the plane is about to land, a charge of magnesium powder is ignited at each end of the wing to furnish light for landing.

Details of Balbo's Squadron

by HARVEY MOEHLLE

The Savoia-Marchetti seaplanes employed on Balbo's epochal flight have many novel features such as double hulls, tandem engines and faired outriggers.

ITALY'S peacetime armada of twenty-four airplanes, led by Gen. Italo Balbo, arrived in Chicago after a trip of 6,100 miles in the total flying time of forty-seven hours, fifty-two minutes. This noteworthy accomplishment of these ships marks a new epoch in long distance massed squadron flight that leads to much speculation.

The squadron flew the trip in easy stages, starting at Orbetello, Italy, and following along essentially the same route charted in the July issue of POPULAR AVIATION. The first hop of 870 miles across Switzerland and Germany was accomplished in 6 hours, 21 minutes. The 630 mile second stage, from Amsterdam to Londonderry, North Ireland, was flown in 6 hours, 12 minutes. The 930 mile over-water flight to Reykjavik, Iceland, took 6 hours, 19 minutes.

Because of unfavorable weather, there was a week's delay until the 1,500 mile hop to Cartwright, Labrador, was undertaken. The time was 12 hours, 28 minutes on this leg of the journey and then the fleet, the next day, covered the 800 mile stretch between Cartwright and Shediac, New Brunswick, in 5 hours, 47 minutes. The 500 miles to Montreal, Quebec, took 3 hours, 54 minutes, and after this came the 870 mile trip to Chicago that consumed 6 hours and 51 minutes. The filotilla arrived at the Century of Progress, July 15.

A three-quarter view of the Italian S. 55X Savoia-Marchetti seaplane at anchor. Note the location of the pilots' compartment in the center of the wing.

The average speed for the entire flight to Chicago was 127 m.p.h. which was quite good, considering that the trip was made from east to west against the prevailing winds.

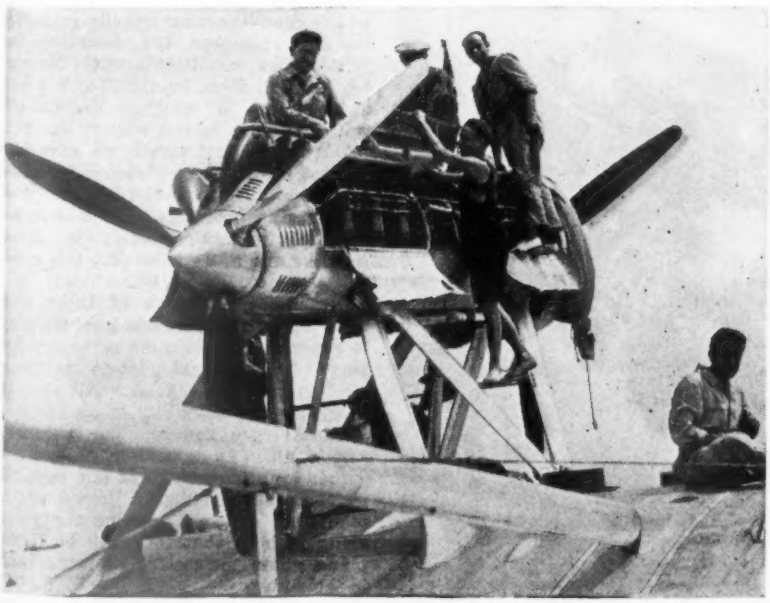
Of greater interest than the flight itself, however, are the Savoia-Marchetti S.55X seaplanes, or rather the duplex flying boats with which the trip was made. These ships are bristling with novel points in design which are worthy of special consideration. They were designed by Alessandro Marchetti and built by the Societa Idrovolanti Alta Italia (S. I. A. I.).

The S.55X boat is a cantilever high-wing type carrying duplex hulls with the tandem engined power-plant located above and in the center of the wing. The hulls are of the single-step type provided with two outriggers for carrying the tail group. The hulls, which are tied together with a horizontal portion of the thick wing, are provided with 18 watertight compartments to insure buoyancy in the case of a forced landing or damage due to landing on a rough sea.

The hulls, which are quite deep in relation to their length, are of wood construction in which spruce, ash and plywood are employed. Below the water line, the thickness of the plywood covering is doubled with doped fabric between the two plates of plywood.

The hulls are used for carrying the fuel, lubricating oil and water, all of which are contained in a series of tanks. The starboard hull carries seven 83-gallon tanks, two 106-gallon tanks and a 40-gallon tank. In the port hull, two of the 83-gallon tanks give way to the radio equipment. This gives a total capacity of 1,500 gallons of gasoline, which is said to be sufficient for a maximum cruising range of 2,800 miles.

In plan form, the wing is tapered with an unusually wide chord at the hulls. Viewed from the front, it will be seen that a considerable dihedral angle is incorporated into the outer wing sections which is not only desirable from the standpoint of stability but which also is a protection for the wing tips in a rough sea. The wing



By this arrangement of the tandem-engine power-plant, engine inspection is simplified and the plant is assured of adequate cooling.

consists of the center section connecting the hulls and the two outer tapered sections. Three main spars of plywood carry the load, the covering also being of plywood.

The pilot's compartment is located in the center wing section, the canopy of which is quite low and well streamlined into the upper surface of the wing. This gives excellent view to the front but it appears that the arrangement is blind at the rear and at least somewhat obstructed at the sides by the dihedral of the wing. It is interesting to note that the pilot views the instruments through a magnifying glass which shows up minor variations in the readings of the instruments very clearly. A Sperry artificial horizon and direction indicator are employed.

SPECIFICATIONS OF THE S.55X

Wing span	71'-11"
Maximum wing chord	16'-3"
Wing area	990 sq. ft.
Overall length	54'-2"
Height	16'-5"
Top Speed	175 m.p.h.
Cruising speed	145 m.p.h.
Average speed during cruise	127 m p.h.
Normal cruising range	2,250 miles.
Maximum cruising range	2,800 miles.
Fuel consumption	1.37 pound per mile.
Power plant, total output	1,760 h.p.
Weight empty	12,650 pounds.
Gasoline capacity	1,500 gals.
Fuel load, approx.	9,800 pounds.

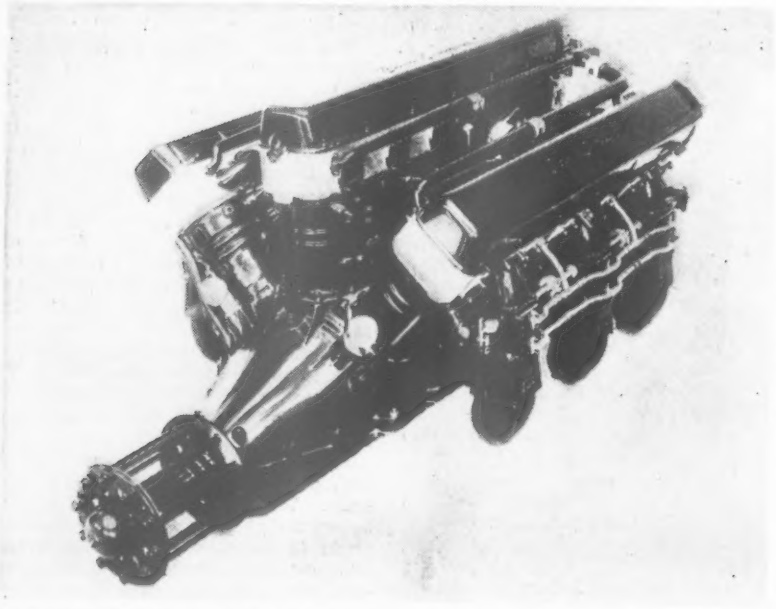
An examination of the power-plant installation shows that it is pitched up toward the front at an unusually steep angle, and at this location it requires a comparatively great elevation above the wing so that the center of thrust is quite high. Whether this introduces a vertical lifting component of noticeable effectiveness for takeoffs is unknown, but it apparently assists.

General Italo Balbo, the intrepid leader of the Italian armada that flew from Italy to the United States.

However, from the fact that two of these boats were upset in landing leads one to believe that this arrangement produces an inconveniently high center of gravity, making it difficult to land with safety. This effect is augmented by the extreme forward position of the powerplant so that the overturning couple is quite large in respect to the resisting couple.

Power is provided by two tandem water-cooled Asso engines built by the Isotta-Fraschini company. The 18 cylinders are arranged in three blocks of six cylinders each, in "fan" formation, with an included angle of 40 degrees between the blocks. Two Marelli magnetos form the ignition group while

(*Concluded on page* 268)



A view of the 18-cylinder "Asso" Isotta-Fraschina engines that propelled the Italian squadron on the journey to the United States and return.

Hollywood Takes to the Air

MANY motion picture stars and other Hollywood film folks have taken up aviation.

Wallace Beery, who owns a Bellanca cabin plane and has more than 1,000 solo hours to his credit, was recently commissioned a lieutenant-commander in the United States Naval Reserve Force, detailed to the flying corps.

Ben Lyon and his wife, Bebe Daniels, own a Stinson cabin monoplane. Lyon is a lieutenant in the United States Army Air Corps Reserve.

Hoot Gibson, flying cowboy of the screen, and Ken Maynard have each done more than 1,000 hours solo. Richard Arlen and Reginald Denny are regarded as veterans.

Howard Hughes, the youthful producer of successful flying pictures, has a Sikrosky amphibion and a Boeing "100" pursuit plane. He has more than 1,500 hours to his credit.

Others of the Hollywood colony who own planes are Victor Flemming, director; Douglas Shearer, sound director and brother of Norma Shearer; Henry Kind, director; Clarence Brown, director; Frank Borzage, director; Buddy Gillespie, art director; Merrill Pye, art director and Hal Mohr, cameraman.

And perhaps the best known of them all is Will Rogers, who is constantly boosting aviation in his daily message published in more than 300 newspapers.

The L. A. A. Makes Progress

WE HAVE encouraging news for the friends of the Lightplane Association of America. At the last minute, as usual, the applications for membership came pouring in at a rate that astonished us.

Things look so bright, at the present, that we will not clamp down so tight on the dead-line, as originally intended, but will postpone the dead-line for membership enrollments until November 1. And then, by the blue heavens above, if the 500 members are not enrolled, there is no use waiting further.

During the past month, we have had a great many letters pleading for more time in which to round up our procrastinating prospects. Some were almost tearful in their entreaties for a reprieve and so we hope that this news will cheer them up a bit.

For the information of those who have come into this game late, we wish to announce that it is not necessary for you to be a licensed pilot to become a member of the L. A. A. All that is necessary for eligibility is an interest in lightplanes and amateur aviation. That's all. As a matter of fact, a rather high percentage of our enrolled members have neither a license nor a plane, but are just boosting the game along in hope that they will be lightplane pilots themselves at some time in the future.

So, come on all you fellows who haven't entered. There's still some time.

Hang 'em on the Wires—Peelot

by MARK MURPHY

They're tearing down the menacing wires around many of the airports, but this does not eliminate the danger of the high-tension wires in the open country. What to do?

HIGH-TENSION electric transmission lines, telephone lines and telegraph lines, while causing many accidents in the past, are becoming more and more of a menace to aviation as time goes on, to judge from the many accidents that have recently taken place.

The accompanying photograph is only one of several similar photographs that have been received at this office during the past three months and it is very fortunate, indeed, that this particular spill did not end in several fatalities. It very graphically portrays the pole-line hazard that confronts every pilot in this country, and this hazard was repeatedly denounced by the late Charles W. Purcell with whom transmission lines were a major sore point in his collection of private peeves.

Just how to avoid this danger is a great problem, for it cannot be expected that the public utility corporations will bury their trunk lines just to satisfy the yearnings of a few pilots. Underground electrical construction is highly expensive, and the overhead charges against such installations would make electrical service prohibitive in the majority of locations. The elimination of such pole-lines in the open country is an impossible dream, therefore we must solve the problem in some other way.

Around the airports, themselves, the matter is different and while dangerous wires still surround many of the older airports and landing fields, yet there is a decided tendency toward remedying this evil at many places. Airports that have been built during the last two or three years, have in the most part, been located at a distance from high-tension lines or pole lines of any kind for that matter, or else the wires have been placed underground in the immediate vicinity of the airports. The Ponca City Municipal Airport, Ponca City, Okla., described in the last issue of POPULAR AVIATION, is a fine example of a wire free airport that should be copied by others.

In the Chicago district, with but few exceptions, the airports are surrounded on all four sides by every sort of a pole-line conceivable. Even at the much lauded Chicago Municipal Airport you can find any sort of circuit, ranging from six volts to 2,200 volts, strung around the field. The fine Pal-Waukee field is just about as bad in this respect while many of the smaller ports are literally wire bird cages. The Elmhurst field, near Chicago, is charmingly situated with a high tension line along one side, the vaulting towers of radio station KYW on the other and with various and sundry telephone lines strung around at inconvenient points. Only good luck has prevented serious accidents at this field.

To strike any wire or obstruction is bad enough when taking off or coming in "dead-stick," but to sit down across the wires of a circuit carrying 1,100 volts or higher is the acme of distress. With such high voltages, the juice is instantly short-circuited by the metal frame and stay wires of the plane, and then comes a nice hot blaze consisting of the electric arc, the flaming fabric and gasoline. You will note in the photo that the fabric is burned off clean and clear and the pilot had a miraculous escape from death.

Conditions are hardly better today than they were in the old cow-pasture barnstorming days when it was not an infrequent spectacle to witness an old Jenny roosting precariously on a telephone line. And even this was not so bad, for the antique wooden construction did not short-circuit the wires unless two of the line wires happened to contact a fitting or the stays. The all-metal ship, however, is a sure cause of a short-circuit and flash, but at the same time it shields the pilot against the possibility of having the current enter his body directly and thereby eliminates the chance of electrocution.

Wires are dangerous principally for the reason they are so small that they can hardly be seen until the plane is almost up against them, and danger of collision with the line is increased a thousandfold in the twilight before the obstruction lights are turned on — if any. Then, again, there is always a chance of trouble with the obstruction lights — the fuses may blow, the supply line may be rendered useless by a storm, or anything else might occur that would cut out the lights for a time. Any danger signal that is worthy of the name, should not be entirely dependent upon the vagaries of an electric lighting circuit—it should be perpetual within itself.

But all the hazards are not night-time hazards by any means, for the writer has seen lines that were practically invisible in bright sunlight. Fields, for example, in which landings must be made over the pole-lines with the sun full in the pilot's face. Situations where the poles are hidden by foliage, buildings or otherwise. Fields where the poles were not painted and where the dark weather-beaten poles camouflage themselves into the landscape.

(*Concluded on page* 276)

Here is where the "Flying Grandmothers" came to grief but were not severely injured in spite of the fact that the fabric was burned off the ship.

Lightplane in Sham Battle

THE First United States Infantry, stationed at Fort Warren, Wyoming, was deployed for a stubborn defense of Cheyenne, Wyoming, against a mythical enemy. High above them a lightplane circled.

At regimental headquarters, six men under the command of Sergeant Gordan jumped to their posts. The pilot of the lightplane opened and closed his throttle three times. *"Where is your command post?"*

Sergeant Gordan's men laid out an identification panel. The lightplane dipped three times in acknowledgement. In rapid succession a series of panels spelled out the message. *The defense is established. Report our location to brigade headquarters.* The lightplane dipped three times in acknowledgement and flew off to deliver the message.

The mission was in the nature of an experiment to see just what could be done with civil aircraft and untrained personnel. The airplane was a Curtiss Wright Junior, loaned for the purpose by the Cheyenne Air Service of Cheyenne, Wyoming. The combined pilot and observer was Lieut. Thomas Kent, an Infantry officer stationed at Fort Warren.

It was quite a job for Lieut. Kent, who is well over six feet tall, to fly the airplane, watch for the panels, decode them and write the message all in the tiny cockpit of the lightplane. Doubly difficult, perhaps, because he is an inexperienced pilot with no knowledge of the Air Corps or its work and also because he was flying a lightplane with a low-powered motor at an altitude of 8,500 feet above sea level.

It is hoped that, in the future, another pilot will be taken along to assist in the flying and observing. If this is possible, more complicated missions can be flown. It is believed that this is the first time a military mission has been flown with civil aircraft and untrained personnel.

It is possible that lightplane pilots and owners can be of great service to the army in the event that regular Air Corps equipment and personnel is not available. Even today, lightplane pilots can give much needed training to themselves and to the army by offering their services to any nearby regular army, national guard or C. M. T. C. station, as the reduced appropriations make it impossible to send the regular Air Corps airplanes to many army posts and camps.

Dogs No Longer Used

DOG teaming out of The Pas, Manitoba, has virtually come to an end due to the rapid increase in use of the airplane by prospectors and others who have business in the Far North. Recently a dog team, harness and Alaskan sled sold for only $75. Three years ago the team would have brought $300.

For Heroism in the Air

by COLIN CAMERON

The Distinguished Flying Cross awarded for deeds of heroism in the air, designed by Miss Elizabeth Will and A. E. DuBois of the War Department.

THE accompanying photograph shows the Distinguished Flying Cross, authorized for award only in cases of "heroism while participating in aerial flights."

Representative of the type of feat that must be accomplished to merit this award under such an apparently simple requirement is the feat of the famous Lone Eagle, Colonel Charles Lindbergh, to whom was presented the first Cross made.

Very simple in design, the cross consists of a cross patee one-and-one-half inches square, upon which is superimposed a four-bladed airplane propeller. Sun rays, representative of the glory and splendor of the rare deed for which the Cross is bestowed, form the square in the angles.

Of bronze, the Cross hangs from a silk ribbon of red, white and blue, the narrow red stripe in the middle and a white stripe near each edge.

The design for the Distinguished Cross was approved by the Fine Arts Commission, Secretary of War, Secretary of the Navy and a composite board of Army and Navy officers, from the design submitted by Miss Elizabeth Will and Mr. A. E. DuBois, employes of the War Department, May, 1927.

O. K.—Hostess

WHEN the flying hostess system was started by Eastern Air Transport, two years ago, the innovation was looked upon with a good deal of interest and some skepticism.

The company has just reported that the psychological and practical effect of having these gracious young women aboard the planes to minister to the comforts of passengers has amply justified the experiment, as has the use of stewardesses who are all trained nurses.

Eight of the 12 Eastern Air Transport hostesses who are on actual flying duty have completed a total of 1,520,000 miles of travel, or 190,000 miles each. Two, Miss Beulah Unruh and Miss Marion Cook, have made more than 250,000 miles each.

Solo Refueling

REFUELING alone in mid-air from another plane was successfully accomplished over a Los Angeles airport by Paul Munro, veteran pilot. Setting the rudder arrangement, Munro left the cockpit of the cabin monoplane and went to the rear of the ship where he snared a fuel hose dangling from a refueling plane overhead. The plane, with its automatic rudder system, was designed and built under Munro's direction.

KDKA's Radio Blimp

EXPERIMENTS were started with KDKA's new blimp antenna, located at Saxonburg, Pa., which may have considerable effect upon the future efficiency of broadcasting stations.

Held aloft by a baby blimp, an odd adjunct to a broadcasting station, an experimental half wave antenna about 500 feet long now trails 1500 feet in the air. A light aluminum wire, serving as a combination guy and feed wire, serves the dual purpose of restraining the "captive aerial" from free flight and "feeds" it radio programs.

A long period of research is anticipated before engineers can accurately determine whether or not this latest experiment in broadcasting will be successful. Theoretically, however, at a distance of 40 miles, signal strength several hundred times that now possible using convention antennae, seems probable.

The KDKA baby blimp taking off with the experimental antenna.

Do Animals Fear Airplanes?

by LAWRENCE CLOUSSING

The writer answers a question often asked of pilots, concerning the reactions of various animals to the roar of a passing airplane. And as luck would have it, a photo of a cow-pasture drama turned up at this time which proves one of his statements.

UP AT about 500 feet we were cruising idly across the country, the Wasp engine in front of us roaring along in its steady beat. A short distance ahead was a farm.

As we approached closer to the farm on a path that would pass it several hundreds yards to one side, a black dot streaked out from the farmhouse. It was a dog, and it was trying to meet us! The path the dog had taken and the speed at which he was traveling were such that if we were on the surface he would have met us in the quickest possible time.

As it was, of course, at that precise moment we were instead about 500 feet above him. There was the dog below, somewhat bewildered, traveling around in circles and looking this way and that, seeing nothing, yet hearing plenty. It is strange the reactions animals have to airplanes traveling overhead.

Some dogs, for instance, if they are good watch dogs, will run as this dog did, trying to locate the thing that is making so much noise. It is remarkable how well they will instinctively calculate the speed of the airplane and its direction so that they are almost always directly under the plane when it passes overhead. But I don't believe that they realize it is up in the air. A good many dogs, of course, will just sit and let the plane fly on over head. Altitude has a good deal to do with the reactions of the various animals. A plane above a 1,000 feet has little if any effect. About 500 feet up animals notice the plane quite readily, and below 500 feet they are extremely conscious of it.

While dogs will run to meet an airplane passing, chickens will do just the opposite. At the first consciousness of an airplane, they will streak for cover as fast as they possibly can. It must be that they think it is a chicken hawk. Whole flocks will crowd into a chicken house at once.

One chicken farmer had an aviator friend, and one day the aviator friend, enjoying himself in the air, thought he would drop over near the chicken farmer's place and give him a zoom just to say "hello." Well, his zoom cost the chicken farmer about 25 dead chickens and a number of broken eggs. He had zoomed right near the chicken house at laying time. The chickens, terrified with fear, had rushed for the coop and those in the coop flew madly about. Eggs which they were about to lay were broken inside of them.

Cows are quite nonchalant, but if a plane is too low they will stop chewing their cud and stand up. As the airplane comes closer, they will start running away before it. Then, as the airplane passes on overhead, they will alter their path to one side or another. When the plane has passed they will start to run backwards.

As Mr. Cloussing predicts, a forced landing in a cow pasture is not easy. Here, one bossy cow is pinned down under the nose of the ship which made a forced landing in her pasture, while her girl friend takes in the show. Neither the pilot nor the cow were injured.

Just then it seems that they think they have been very foolish and so they stop and with a sort of a bewildered and rather apparent self-conciousness, they take a nibble of grass and look around sheepishly as if to see if any of their comrades are making fun of them.

Horses are similar, only they are more active. They, on hearing the airplane, will toss their mane and look about. Then they will run a little way and stop and listen again, and then will run some more. The most intimate experience I ever had with an airplane and a horse was when I landed an airplane on a field where a horse was grazing. Not that there ever was any danger of running into the horse, but the actions of the horse were interesting when he was at such close range. When I made a pass at the field, the horse looked up and gazed as though consumed with curiosity. But just as I passed close by him he turned heels and ran, stopping within a few feet and then turning his head to look backwards to see what happened to the roaring bird. He was never scared—he was just cautious.

If a pilot has made a forced landing in a pasture, it is no trick at all for him to clear it of cows, horses and sheep for his take-off. All he has to do is run up the field with his engine roar scaring the animals to whatever part of the field he is not going to use. Then he has a clear run for the take-off. However, clearing a field for a forced landing I am afraid would not be so easy.

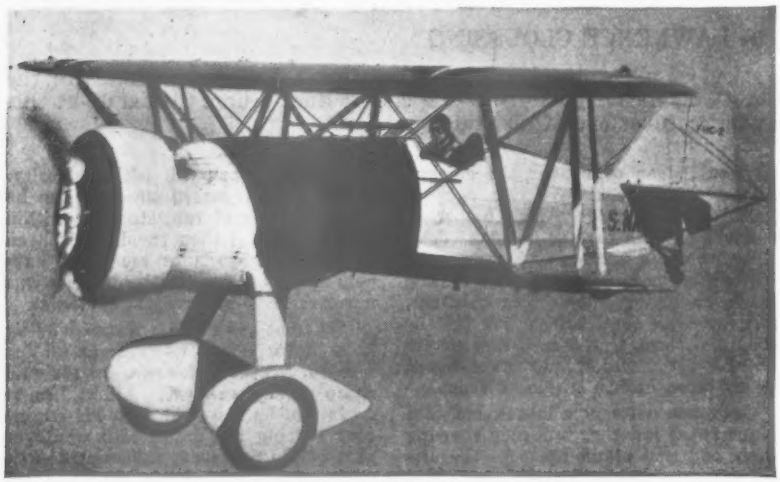
Sheep follow one another. Upon hearing an airplane, one sheep will probably start to go through a gate in a pen to run away from the noise. All the rest will follow the leader, and in no time the gate is piled full of sheep all trying to get through and none succeeding. Out in open fields the flock will run together.

Out in the grazing lands of the Dakotas, where huge herds of cattle are grazing, the passage of an airplane overhead has a curious effect. The herd will draw together. The outside cattle will run for the center, and where, before the airplane came the cattle would be widely scattered, after passing they will be huddled together.

Deer and wild game can be easily spotted from the air. One airline pilot, on a run in Northern Minnesota, spotted at least sixty deer during an hour's run. He also spotted so many deer hunters per square mile that he was surprised that more deer hunters were not shot than deer.

Antelope, probably the most curious and reckless of four-footed animals, will run with the plane, at the same time gazing up at it. A whole herd of antelope will run along under the plane at full speed, and this is a speed of about 60 miles-per-hour, with their necks craned at the ship above them.

New Fighters for the Navy "High Hats"



Twenty-eight of these Curtiss F11C-2 ships will be turned over to the "High Hat" squadron of the U. S. Navy. Look at the "spats."

THE Curtiss Aeroplane and Motor Company, Buffalo, New York, announce the purchase of 28 Curtiss Hawk fast single-seat Navy fighting biplanes, amounting to approximately $500,000. These planes, known as the Curtiss F11C-2, will operate at the Naval Operation Base at North Island, San Diego, California.

The F11C-2 is the latest model of the famous Hawks that have been produced over the past ten years for the United States Navy. These planes will constitute the new flying equipment for the famous High Hat Squadron, expert flyers of the United States Navy.

The Curtiss F11C-2 is powered by a 9-cylinder 700 horsepower Wright Cyclone engine, which weighs only 1.22 pounds per horsepower. The new Cyclone is equipped with a down-draft carbureter which takes in air at the top of the engine. This has a decided advantage, not only because it eliminates the possibility of dirt and grit entering the carbureter, but because it makes the other accessories such as magnetos, starters, and generators, more easily available.

These new Navy "Hawks" are equipped with the Curtiss single strut landing gear. The "pants" on the F11C-2 are cut away so the wheel can be serviced without first removing the fairing. Thus, all the disadvantages of wheel fairing have been eliminated and all the advantages retained.

Air Mail Veteran to Work on Ground

ONE night, Verne Treat, dean of the New York-Atlanta night air mail, took a hitch in his trousers and a look at the sky, but he couldn't take the suggestion of a lump out of his throat. For he wasn't bothered that night about the weather charts, and he wasn't figuring on awakening in the dawn with his ears tuned to the drone of mail ships dropping out of the sky.

That morning he had made his last flight, landing on scheduled time at Newark airport from Richmond, after doing nearly half a million miles from the heart of the Old Colony region, over the nation's capital at Washington, to the Jersey meadows. He hadn't been let out. He had quit for good at 39, to take a Chevrolet agency near Red Bank, N. J., which is his home.

Verne Treat is one veteran who never cared for flying jinxes. If he saw one, he kicked it in the pants or put ants in its Sunday shirt. The result was, the tribe got tired of pestering him after a while, but for a while he surely was pestered, just the same.

Did anybody ever hear of a locomotive engineer that had made a total of 20 special reports covering wrecks, emergency stops, etc., without getting stove up at some time during the process? They say the rails are safer—but are there any figures like that available? There are not. Yet Treat has had a score of emergency landings, some involving bad crack-ups and has come out with a whole skin. . .and the mail has gone through.

"It's a tough racket, flying the night mail—and besides, it's getting cold," he half apologized, two weeks before he signed off the pilot list, in explanation of the rumors that had been going around for several days and nights.

"It's going to seem funny not to be flying. I guess I'll miss it." And he does miss it. He had been making the night trip from New York to Richmond every night for four years and a half.

(*Concluded on page* 273)

Official Squadron Insignias

(*See opposite page*)

TAKEN in combination with the illustrations on the opposite page, the following specifications will be of interest to our model builders and Photo Fans who wish authentic information on the squadron insignias used by the U. S. Army Air Corps.

1st Observation Squadron—A brown cave man wearing a black breech clout, standing on a black mound, looking to dexter with right hand shielding his eyes, left hand holding a spear horizontally, in front of a rising sun against a blue background all within a green bordered gold annulet bearing thirteen black crosses patee.

94th Pursuit Squadron—American Indian Head, face brown with black, blue and red markings. War bonnet white feathers tipped with blue, yellow and blue head bands, ribbons red and blue.

16th Observation Squadron—Binoculars, white with black shading.

95th Pursuit Squadron—Mule, brown on light blue circular background.

22nd Observation Squadron—Blue disc, white stars, red to yellow tail.

9th Bombardment Squadron—Black disc, within an orle of silver another disc gray and black, Roman numeral IX in silver.

26th Attack Squadron—Shield—upper half orange; lower half, blue. Clenched fist, upper half blue; lower half, orange.

8th Attack Squadron—Eagle proper, white head. Bell, blue. Center circle white. Middle circle, green. Outer circle, yellow.

24th Pursuit Squadron—Tiger in proper colors.

44th Observation Squadron—Indian in blue silhouette on yellow disc piped with red.

27th Pursuit Squadron—Falcon, proper on a red disc.

2d Observation Squadron—A white disc within a black circle, rising out of green sea in the lower part of the disc Neptune riding a seahorse and holding in his hand a trident in black silhouette.

19th Pursuit Squadron—Cock, black and white, red comb, on yellow disc, black border, 19 rosettes consisting of six pointed star and six dots all white.

3d Pursuit Squadron—On a blue triangle piped in black point down a fanciful creature with the head of a parrot, the winged trunk of a lion and the tail of a sea serpent. Black head and trunk, red and white eye, orange bill, red tongue, white wing and orange tail.

55th Pursuit Squadron—Yellow disc bordered in blue, blue annulet, arrow and sword black, portion on border yellow. Wings proper.

99th Observation Squadron—Buffalo, red lined with blue.

34th Pursuit Squadron—Black futuristic bird, red eyes, red and white striped breast, red lightning on white circular background piped in black.

73d Pursuit Squadron—Golden bear with black shading, red eyes and tongue, on blue circular background piped in yellow.

11th Bombardment Squadron—Jiggs, black suit and hat, red vest, blue tie, white spats, light blue bomb, trimmed in orange, on circular white background with black piping.

91st Observation Squadron—Gray armor, green shield, black cross piped with white, yellow plume, brown spear, black

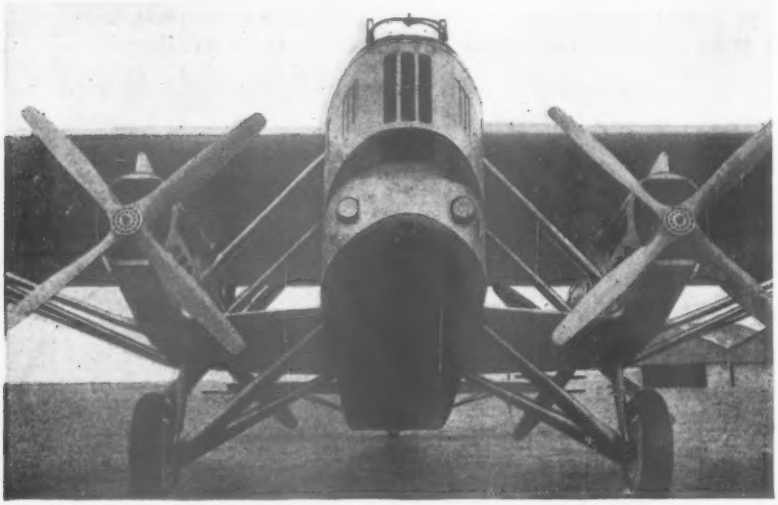
(*Concluded on page* 274)

Official Insignia

Squadron insignia has always been of great interest to our Photo Phans and model builders who have had considerable difficulty in securing these "trade-marks" in the past. You will find a complete description on the opposite page. This is an official photo supplied by the U. S. Army Air Corps.

A Twin-Motored Farman Bombing Plane

by FLETCHER PRATT



Front elevation of the Farman sesquiplane bomber in which Warren trussing is employed for the support of the engine units and wings. Air brakes are supplied for landing.

A NEW night bomber of highly original type, great power, and unusual characteristics is the latest machine to come from the Farman factories in France. It has attracted widespread European attention following its first successful tests at Villacoublay.

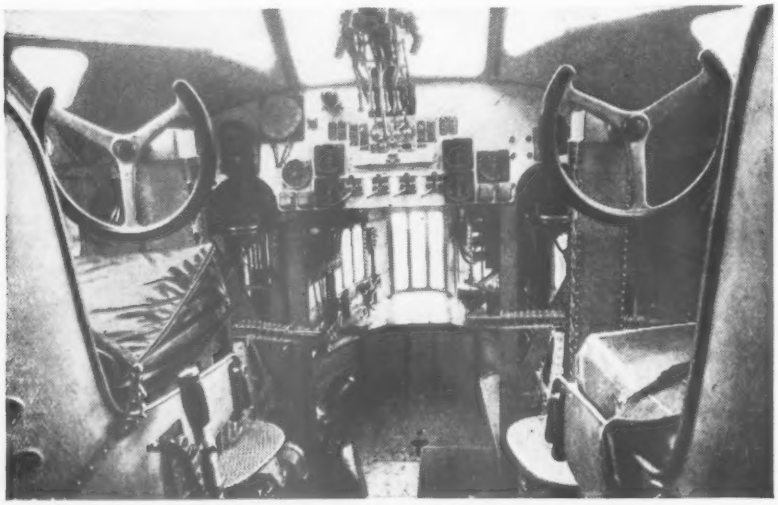
It is a four-motored machine with the motors located in two groups of two each, adopting the monoplane set-up popular in American bombing machines but hitherto looked on with considerable skepticism in Europe. It is composed of standardized parts that can be completely knocked down, shipped in a case and re-assembled for flying in a very brief space of time.

When it is understood that the new Farman has a useful load of over 14,000 pounds and a radius of action of 750 miles, it can be realized what this knock-down feature means.

The new machine is a sesquiplane having cantilever wings, with the motors grouped in pairs on either side of the fuselage. The four motors are Hispano-Suiza 12's of 600 h.p. each, giving the machine a total power of 2400 h.p. It has a wing-spread of 118 feet and in addition to its cargo of bombs, is intended for a crew of five.

The normal load of bombs is 4,800 pounds, but it can carry up to double this amount. Flight tests at Villacoublay showed it had a top air-speed of 142 m.p.h., remarkable for so heavy a machine, and could climb to 12,000 feet in 25 minutes. The ceiling is 18,000 feet.

The controls are double, and extraordinary care has been taken in making the fuselage sound-proof; in the flight tests conversation was carried on in an ordinary tone during flight.



Interior of the pilot's compartment in the new Farman Bomber. It will be noted that there is plenty of "elbow room" between the two pilots' seats.

U. S. Is Ahead of European Countries

IT IS quite agreeable to have such an authority on aviation as Dr. Erich Schatzki, one of Europe's outstanding aeronautical engineers who is in this country inspecting the general operation of United States air lines, make such a statement as "The United States is fully two years ahead of European countries in development of aircraft for general air travel."

Dr. Schatzki made his statement after an exhaustive study of the maintenance base and operations headquarters of Transcontinental & Western Air, Inc., Kansas City.

"European lines have not found the reliability in their motors that American lines have provided," Dr. Schatzki said, "and for that reason European lines find it necessary to carry a 100 percent reserve of spare motors. If there are fifty motors in daily operation on any line, there are also fifty motors held in reserve at the various repair depots."

Dr. Schatzki is decidedly in favor of the present American trend toward twin motor planes to supplant the trimotor planes now in general use. He believes that the twin motor will result in greater safety as well as greater efficiency for it will develop a much higher cruising speed with little or no increase in its landing speed.

Dr. Schatzki was formerly chief engineer of Luft Hansa, the gigantic air system and is now representing Swissair of Zurich, Switzerland.

Use Feathers in Planes

FEATHERED planes are the newest thing in the line of aerial experiments. But the feathers are inside, not outside.

Experts, seeking for something to make transport planes, especially the multi-motored kinds, sound-proof, are now testing double walls for plane cabins with the spaces filled with feathers. They have found that the quill of feathers absorbs sound after it is transmitted from the tiny vanes.

British Study Vultures

INDIAN vultures that make use of air currents to climb upward and upward, wheeling in great spirals for hours on end without once flapping their wings, will be closely observed by scientists of the British Gliding Association who are planning researches into thermal air currents to aid the art of soaring and gliding.

The currents, it has been noted, rise from a ridge of rock, an area of sand, a big stone building or even a group of mud huts heated by the sun. In these currents, vultures often climb to a height of 2,000 feet and float all day without a wing beat, gliding from up-current to up-current and rising in wide circles when they find themselves in an area of lift.

How a Chinese Student Soloed

by SAMMY LEE

An air-minded Chinese lad gives a highly humorous description of the trials that await beginners in aviation and how he finally soloed under the instructions of a typical barnstorming instructor. Besides being a good story, this article is quite instructive.

I WATCHED the plane until it reached the Golden Gate. It banked and hung like a black falcon in the sky and reminded me of the great gyrs of Manchuria.

It whirled and roared. I tried to imagine myself in the cockpit. Then the wings flashed in the red sunset and the airmen came to earth at Crissy Field.

That night I walked along the beach many miles. Perhaps this might be the adventure I had missed since leaving the battle fields of Manchuria. I reached a street car and bounced home. The day before had been my birthday and grandfather Lee had bestowed upon me a magnificent present of two hundred dollars in American money.

That night I decided to postpone my marriage to some future date. The later the better. Miss Quong would undoubtedly expect me to work. Yes, the later the better.

The following morning I walked ten miles to the San Francisco Airport. Not many planes were out of the hangars. I tried to act nonchalantly as I strolled among them.

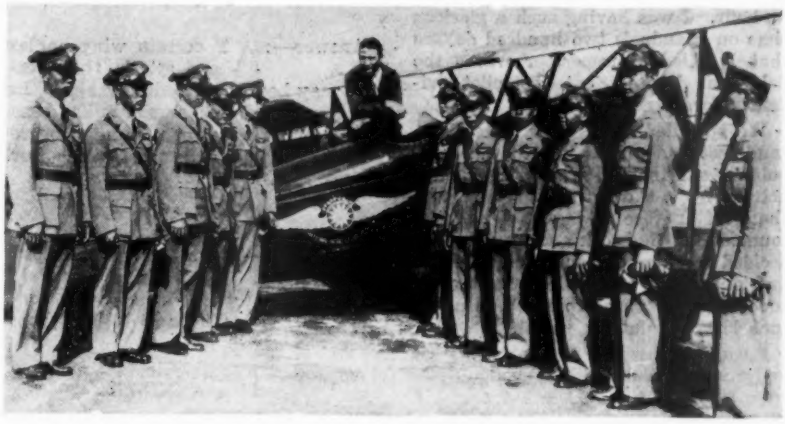
A tall man with flying clothes approached me and asked me if I wanted to "go up." I answered that all my life had been lived for that very thing. And so I went on my first airplane ride. I determined to learn to fly instead of spending all of the two hundred of grandfather's dollars in joy hops.

I was soon talking airplanes with the sky-riding gentleman and learned that he was beyond all doubt the greatest pilot in the U. S. A. (Later I learned that all men of this calling claim this modest title.) And also that he would condescend to give me the instructions for which I yearned, for the exact sum of grandfather's gift. The air must have dulled my trading instincts considerably or I would never have let that piece of information leak out.

First of all, to become an aviator, I would have to pass a government physical examination. I took the address the flyer gave me and hurried all the way back to the city (ten miles) on foot. After much prying, peering and pulling, I learned to my relief that I had passed the examination. Then the swearing began (the notary kind of course) on both sides and one more Chinaman was handed a student-pilot's permit.

"There," said the kindly doctor, "you can break your blankity-blank fool neck."

My entire evening was spent in the back of grandfather's curio-shop poring over a book, a beautiful red book entitled "Learn to Fly in Half an Hour." Though I worked prodigiously for many half hours, I was sure I hadn't gained the meaty essence of "Learn to Fly in Half an Hour" and tossed that same document into the coal brazier.



Perhaps Sammy Lee had patriotic motives in taking up training and had ambitions pointing toward enlisting with these Chinese cadets who were trained in California for active service in Manchuria.

The next morning I was an hour ahead of time. I ran much of the way in my eagerness. But the pilot was some two hours late. I learned later that aviation pilots take their engagements lightly and indeed, two hours late was something to be thankful for.

I soon found myself struggling into a helmet with goggles and a huge flying suit. While the pilot's back was turned I utilized a nearby ladder and so negotiated the rear cockpit neatly. He was not at all kind in his remarks about a son of Han about my age and height.

The motor was roaring and the wind from the propeller tore at my face, which I had hoisted above the windshield in order not to miss any of the pilot's operations in the front cockpit.

He suggested that I sit down and utilize the safety-strap, as it might do much to keep certain parts of my anatomy in contact with the airplane seat. The plane skidded around. We bounded out across the field. As the plane stopped, the pilot pointed at an object that greatly resembled the leg from a pair of my venerable grandfather's red drawers and informed me that *that* was the wind-sock and that I must *always* take-off into the wind as indicated by that vane.

"Sure. Sure!" I yelled, "when do you want me to take off?"

"What do you mean, YOU take-off?"

After such an outburst I humbly ceased churning on the stick and sat back waiting for something to happen.

It did! The motor roared and spit! The wind howled by my helmeted ears. I could feel the tail of the ship lift under me and away we bounded over the field. I saw the dial before me . . . seventy miles an hour! The wheels left the ground. Flying! I glanced indifferently down and back.

I need hardly say that my nerve centers received the shock of their lives at what they saw whirling below. Buildings, hangars, field, planes . . . looked like they were being scrambled together in a huge frying-pan. I looked straight ahead. In that direction I saw the back of the aviator's head, the engine and the wings stretching out on both sides. I suddenly felt a great longing for Miss Quong. The instructor pointed downward.

Such manners. A grave-yard!

Before I had time to compose my slightly agitated mental faculties, the pilot placed both hands on the top of his helmet. I hoped I had gained something from "Learn to Fly in Half an Hour," and thereupon seized the stick and proceeded to fly as per instructions. Something promptly went wrong with the instructions or else I had not interpreted them as the author had intended, for the plane went into a nose dive. I hauled back on the stick. "Up" . . . came the nose!

Hurray!

Down! . . . Up! . . . and beyond!

Whoopie!

I felt the stick jerk out of my hands and the red face of the pilot shouted

back at me above the throttled motor, "Whad'a think you're drivin . . . a laundry wagon?"

Now I have never driven a laundry wagon, and said so.

His hands went up to the helmet again. I took hold. My . . . my! I did somewhat better, ending up merely in a tail-spin.

We flew, or rather the aviator flew, in between my spasms, for about half-an-hour. I was having such a glorious time on grandpa's two hundred dollars that I failed to remember where the field was located, but the pilot evidently forgot no such items.

We spiralled down to about a thousand feet and turned into the field. He pointed out the red-drawer-legs and I noted with a shock that the wind had changed. Before taking off I had discounted the wind-sock and secretly had decided to ignore all such small details and stick only to the important ones, such as getting back to earth. But all such lofty resolutions vanished.

I was supposed to stay on my stick and rudder-pedals with the pilot. We were gliding at a rather flat angle, I thought, and immediately sought to correct this obvious error on the part of the pilot, by pushing forward on the stick.

"Back!" . . . it flew out of my hand!

At a distance that I judged to be anywhere from one hundred feet to six feet, we began rounding out the glide, until just before the wheels struck the streaking ground, the tail dropped to their level. We whirled on terra-firma for quite a distance before coming to a stop. The rudder pedals, I noted, were working spasmodically under pressure from the busy pilot.

I took as much pride in the event as if I had actually done it all myself, indeed; the small boy following the parade couldn't have been more delighted. From that day on I was "sold" on flying. The next morning it was the same, only not quite so bad: and the next a little less worse, and so on; each time less and less awkward. A half-hour each day was enough; so my shoes were beginning to wear very thin by this time.

When nine of these afternoons had sped, I was actually getting the "feel" of the plane, and could take off (after a fashion) and land (after a fashion) with little or no help from the winged-god up in front. We were nearing the end of the ninth lesson or four-hours and a half, when the instructor treated me to a little thrill by climbing out of the cockpit. I couldn't remember that this had happened before in the middle of the field. "Oh well," I breathed, "probably just a tack in his cushion."

But I was doubtful of the tack having caused his evacuation as he stood beside me and began thundering in my ear, "take the old clunk around alone."

"My word!" I said scandalized.

(*Concluded on page 277*)

QUESTION AND ANSWER DEPARTMENT

All questions of general interest on any phase of aviation will be answered authoritatively by POPULAR AVIATION'S Technical Staff.

QUESTION:—Erwin Kent, Memphis, Tenn. *Is the pressure on the leading edge of a wing much greater than over the rest of the wing?*

* * *

Answer—: AT certain wing angles and speeds, this pressure may become exceedingly high. In a power dive, for example, it has been found that the leading edge pressure may be as high as 450 pounds per square foot.

* * *

QUESTION:—Thos. H. Buehlow, Butte, Mont. *What is the "Moly Chrome" steel used in aircraft construction? How does it differ from other steels?*

Answer—: PLAIN "carbon" steel is very nearly pure iron except for a small percentage of carbon contained in solution. High carbon steel can be hardened and its tensile strength can be increased by heat treatment but when hardened beyond a certain point it becomes brittle. On the other hand, if the rare metals molybdenum and chromium are mixed in the steel, the steel is toughened and made more resistant to crystallization.

* * *

QUESTION:—Mark A. Lewis, Sheboygan, Wis. *I have heard it said that the color of the exhaust flame is a means of judging the nature of the carbureter adjustment. If this is so, please tell me how it works out.*

Answer:—WHEN the mixture is correct, the exhaust flames are a deep violet or indigo color. An excessively rich mixture causes a red sooty flame while excess air tends toward producing a greenish-blue flame.

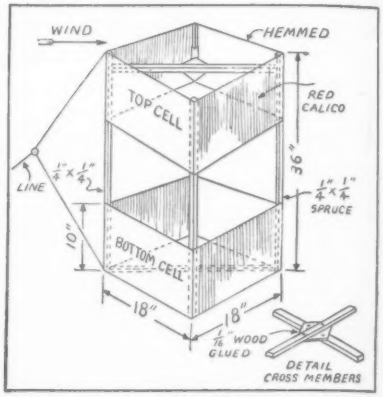
* * *

QUESTION:—J. G. Holden, Sacramento, Cal. *Are there any parts of a plane or aviation engine where cast iron can be used to advantage? If so, please tell me what they are.*

Answer:— THERE are no parts that can be made of cast iron with safety with the possible exception of small engine cylinders. Cast iron is very weak for its weight, is uncertain under vibration and severe shocks and is particularly weak in tension.

* * *

QUESTION:—Arthur Freund, Portland, Me. *Are there any methods of controlling the flow of air over the back of a wing without using the patented wing slots and flaps?*



Drawings for a static collecting box kite for experimental purposes.

Answer:—SO far as this department is aware, there are no mechanical methods to duplicate the action of the slots and flaps, but some laboratory experiments have recently been conducted with fair success in which the flow is controlled by electrostatic charges on the wing. Whether this would prove out in full scale practice would be difficult to predict.

* * *

QUESTION:—Merton J. Adams, Birmingham, Ala. *I have been making a number of experiments with a home-made wind-tunnel, but wish to trace out the streamline flow with smoke. Please tell me how to make this smoke.*

Answer:—PROBABLY the most simple and satisfactory method of making the dense white smoke that would be required, would be the smoke candles or flares that are obtainable from fireworks manufacturers, aeronautical supply houses or railroad supply houses. Red railroad flares, or red fire, makes a suitable smoke.

The other alternative would be to place a jar of concentrated aqua ammonia close to a jar of concentrated hydrochloric acid in such a manner that the fumes of the ammonia are drawn across the top of the acid jar. The acid vapor mixing with the ammonia vapor produces a dense white cloud of ammonium chloride.

* * *

QUESTION:—George Meyers, Central City, Nebr. *Is it possible to make a kite by which I could duplicate Benjamin Franklin's experiment of drawing electricity from the sky? Please suggest a method of making such a kite, if it is practicable to make.*

Answer:—MAKE an ordinary box kite or "three-stick-er." Cover the kite with heavy gilt

(*Concluded on page 269*)

Uncle Sam is Prepared for War

by WALTER E. BURTON

Victory in war depends largely upon industrial preparedness, and according to the author, our country is well equipped for turning out aeronautic equipment speedily. This article was checked and approved by the Materiel Division, U. S. Army Air Corps.

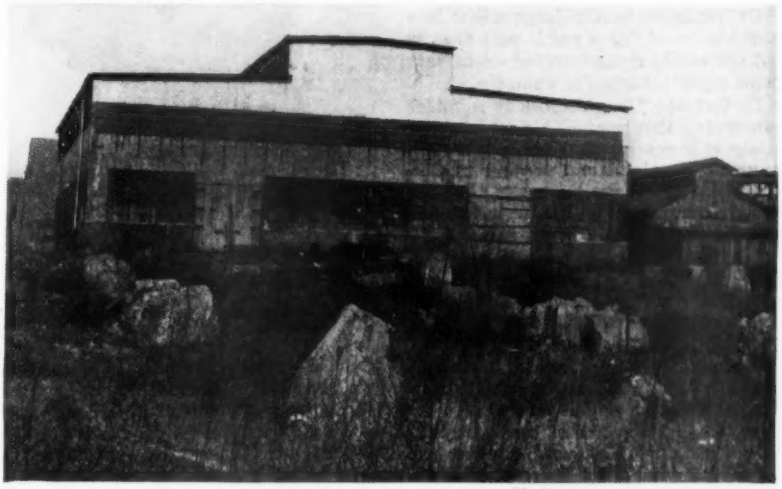
IF THERE ever is another war in which the United States takes part, one of the first units to go into action will be a vast industrial army composed of manufacturers whose plants are equipped to produce every war material from bombing planes to common pins.

Peace-time mobilization of America's army of makers-of-things has been going on for a number of years, and today is one of Uncle Sam's most forceful gestures towards the avoidance of future wars. A country which can, almost over night, start turning out war supplies in quantity sufficient for the needs of the greatest conflict possible is not as likely to be bothered by an aggressor as if it were wholly unprepared.

One of the duties of the office of the Assistant Secretary of War is to keep tab on manufacturers and make sure that they are ready to turn their attention to the production of every conceivable kind of war material on short notice.

At Wright Field, the Army Air Corps' engineering center at Dayton, Ohio, there is a typical unit which carries on such work. Its job is to line up manufacturers of aviation products, from whole airplanes to the smallest plane parts. Captain R. B. Hough, Jr., is in charge of this unit, known as the Industrial War Plans Section of the Air Corps.

In addition to five commissioned officers and a clerical staff in his office, Captain Hough has in the field six district officers who are, in turn, aided by numerous civilian engineers, and other experts who are qualified to hold five-year reserve commissions.



U. S. Army Air Corps Photo

The waste of industrial unpreparedness as testified by these ruined munition buildings rushed to completion during the last war. Sunken foundations, hastily erected on quicksand are in the foreground.

This group has worked out an elaborate schedule of things that would be needed to carry on the Air Corps' share of a conflict. For example, balloons of various kinds are used by the army.

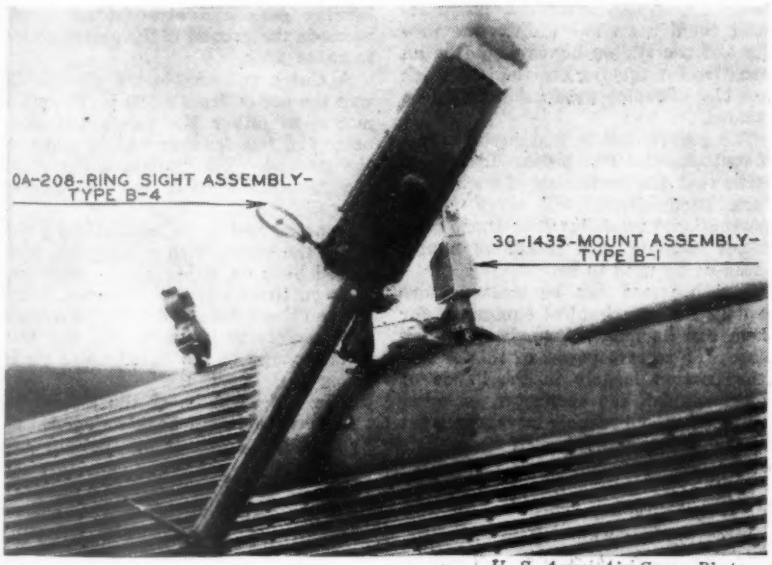
It is known just how many balloons would be required to bring the army's gas-bag force up to full war-time strength and how many would be needed after that for replacements. So the field men are told to locate all manufacturers who are equipped to make balloons, or whose plants could be converted for that purpose without much difficulty.

It so happens that, as far as balloons are concerned, there is one plant capable of turning out all needed.

The district officer, in whose territory that factory is situated, has taken the Air Corps' requirements to the manufacturer and has had him estimate his plant capacity for balloons. He has prepared a list of special equipment needed, perhaps has had factory plans drawn and carried out other arrangements. He may have been instrumental in securing reserve commissions for some of the civilian engineers who have specialized in balloon making.

A detailed summary of the balloon situation is prepared and eventually placed in the Air Corps files at Dayton. This summary presents, first, a description of the balloons that would be needed, free balloons for training purposes, captive bags for observation, etc. Specifications are given and a statement is made of the number of each required in event of war. Replacement rates are listed. Production is plotted against requirements to produce a curve that tells at a glance much about the balloon making abilities of this country.

A detailed list of the workmen needed to produce balloons is next prepared. Cost is estimated. Special parts and materials are quoted and perhaps



U. S. Army Air Corps Photo

One of the many items that must be rushed into production in case of war. An airplane camera used for photographing enemy positions, is scheduled with production numbers as indicated.

information concerning their availability is included. The summary tells whether an extra power load would be thrown on the electric supply system of the community in which the factory is situated in order to turn out balloons at the desired rate. The summary includes blue prints and photographs that give a more definite picture of the balloon resources of Uncle Sam.

Or, perhaps the Air Corps might face a sudden need for a small part that is not ordinarily manufactured—a certain bomb-sight mount, for example.

In Captain Hough's files is a folder concerning this mount. A few minutes' study of it reveals that there is a company in Cleveland and another in Chicago that can make the part; that one of the companies has had experience in just such work, and is prepared to go into production immediately. The other manufacturer would require several weeks before he could deliver the first order; and a few more weeks to get into full production.

The mount would cost in the neighborhood of six dollars, and 5.12 man-hours of labor would be required for each piece. The list of workmen who would be utilized includes 4 screw machine operators, 2 milling machine operators, 2 drill press men, 2 general machinists, 8 bench men, 2 welders, one designer for a period of two weeks and 6 tool makers for five weeks.

The only raw material that might prove difficult to obtain would be 300 pounds of manganese for the production of steel. Other special parts would include certain nuts and washers, aluminum castings that could be obtained from a number of sources, and certain bar, strip steel and seamless steel tube stock.

There are data books of this nature for every item that the Air Corps would require—from a complete bombing plane to small levers or other parts that are not normally produced in quantity by American factories. These books are kept up-to-date, being changed whenever a new factory appears or an old one suspends operations.

The six district officers that the Air Corps has sent out as industrial scouts have headquarters respectively in New York City, Buffalo, Cleveland, Detroit, Chicago, and San Francisco. They secure, as aides, experienced civilians qualified for reserve commissions. Commissions are not handed out in wholesale lots: instead, those who receive them are selected with great care from a large group of applicants.

If you are wondering whether you might procure such a commission you will profit by turning your attention to something else, for all vacancies are at this time filled and probably will remain that way for a considerable time to come.

By mobilizing industry in peace time, Uncle Sam is prepared to gain numerous advantages in event of war. There would be a swift but orderly stepping up of production to a war-time basis, instead of the hopeless tangle of activities that was caused by the World War. The government would not have to spend public funds for the erection of new factories that, after the war, probably would be scrapped.

Every item entering into the manufacture of this oxygen helmet is listed, and all of the possible makers are known, as well as the time taken and the source of the materials.

Instead, the manufacture of war materials would be spread as evenly as possible throughout the industry, with very few plants devoting more than half of their capacities to war work. In this way, civilian business would not be crippled. After peace had been restored, factories could return without difficulty to a normal basis and a depression similar to that which visited this country in 1921 would be avoided.

"Cost plus" contracts have been outlawed and in their place would be adjusted-compensation contracts that provide a bonus which can be increased or decreased in accordance with the performance of the contract in question. Under this system, a manufacturer could not make unfair war profits and the sliding bonus would be an incentive for turning out the best work possible. Surplus production would be avoided.

The government is making no secret of its industrial war plans. Instead, it hopes that the perfection of such elaborate preparations will serve as an international reminder that Uncle Sam is not napping, and is not as unprepared as he used to be.

Fighting men can be trained more rapidly than mechanical equipment for them can be made, a condition which places the reserve power of this or any other nation largely in the hands of the machinist, the carpenter, or other workmen who probably never will get nearer a front-line trench than their workbenches.

And so, all of the elements of modern aerial warfare are scheduled for production just like manufactured merchandise is scheduled for production in peace-time.

END.

Record Forced Landings

MARCH FIELD pilots claim all records broken when in one day nineteen planes were forced to make landings away from the home Post.

They had gone to Boulder Dam to make a survey of progress and upon starting home ran into a heavy rain and snow storm rising about the mountains which they would have to negotiate before reaching the field.

A one day supply of rations were carried along and the pilots knew that they would have to reach civilization or go hungry. Six ships flew down the range, cut across and landed at Calexico on the Mexican border.

Another group flying over Death Valley, where snow was falling for the first time in years, were forced to make landings on a dry lake bed. They had to wait until the storm had passed.

Seven pursuits, two transports and one tri-motored plane carrying nine passengers flew down the range and landed at Blythe, California. It was two days later before they all reached home base.

An Automobile That Flies

AND now an automobile that flies! Yes, it is true. And one is being designed by Morton Bach, "Early Bird," and inventor of the Bach tri-motored planes.

Bach, in company with C. O. Prest, also an "Early Bird," were the first two flyers to make the aerial trip to Alaska. This was in the days before the Army flyers made their epochal flight to that far off territory.

Bach conceived the idea to meet and supply a need, more, perhaps, than a demand. The new plane is designed somewhat like the flying coupe, with a cabin capable of seating two persons. Three doughnut air-wheels, two in front and one in the rear, form the landing gear and also act as wheels when on the ground if the owner wishes it as an auto.

A clutch will enable the pilot to direct the power from a 120 H. P. pusher motor, to either the ship's propeller, or to the two leading wheels when on the ground. The unique thing about the 'autoplane' will be the folding wings.

Imagine seeing an automobile going down the street with a long flat wing folded back on either side! And running on three wheels! Strange things happen these days and with intoxicants having free reign, who will say that it is strange to see automobiles really flying?

The wing will be of the mono-type, and may be folded back or opened up by a crank operated by the pilot, or chauffeur.

The wing is also detachable and may be taken off or attached within three minutes. The rear part of the fuselage may be removed when not in use for flying. We are keenly anticipating the results of this strange combination.

XUM

Details of the 14-Cylinder Wasps

The Twin Wasp and the Twin Wasp Junior are high powered engines that are rapidly coming to the front in military and commercial service. The employment of fourteen small cylinders in two rows greatly reduces the inertia vibration

AS A result of an extensive development program, carried on with the cooperation of the U. S. Navy Bureau of Aeronautics and the U. S. Army Air Corps, The Pratt & Whitney Aircraft Company developed and marketed two sizes of 14-cylinder two-row aircooled engines—the Twin Wasp Junior and the Twin Wasp.

The Twin Wasp Junior has a displacement of 1535 cubic inches and has a rating of 700 h. p. at 2500 r. p. m., maintained to 8000 feet by supercharging. The actual average power developed during test was 725 h. p. at the rated speed, while the average fuel and oil consumptions were .55 and .019 pound per brake-horse-power-hour, respectively.

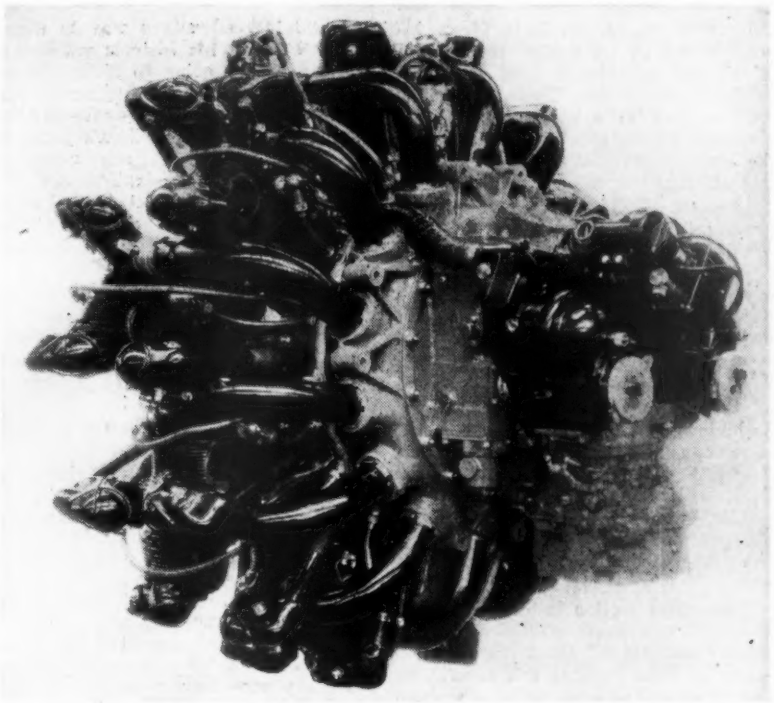
Due to many induction-system improvements affecting mixture distribution, exceedingly low fuel consumptions are obtained. In the cruising range, specific consumptions of .44 pounds h. p.-hr. have been consistently recorded and, allowing for the most adverse conditions of service, the average cruising consumption should not exceed .46 lb. per h.p.-hr. The weight of the engine is 975 pounds, giving an actual weight of 1.34 pound per horsepower.

The larger engine, the Twin Wasp, has a displacement of 1830 cubic inches. It has a rating of 800 h. p. at 2400 r. p. m., maintained to 4500 feet by supercharging. The actual average power developed on a 100-hour test was 830 h.p. The average fuel consumption during the test was .55 pound per h.p.-hr. and the oil consumption was .027 pound per h.p. hr. As in the smaller two-row model, exceptionally good economy is obtained in the cruising fuel consumption.

The actual weight per horsepower is 1.36 pound, the total weight of the engine being 1125 pounds. The propeller reduction-gear ratio is 3:2. By a rather large margin, it is the most powerful American production aircooled engine today.

An outstanding feature of both engines is the cylinder shrouding or baffling which is furnished complete as part of the engine. It has been designed not only to give maximum cylinder cooling, but also to provide for minimum drag when used with high-speed cowling.

In order to determine how nearly an actual engine of the two-row type would bear out its theoretical advantages, Pratt & Whitney started the construction of a two-row engine of approximately 2300 cubic inches in the fall of 1929. This engine had two rows of seven cylinders each and was fitted with a 2:1 propeller reduction gear. During 1930 this engine was thoroughly tested on the dynamometers and torque stands in Hartford, after which it was installed in a Boeing 4CB-4 airplane and given extensive flight tests.



The Pratt & Whitney Twin Wasp engine showing the accessories. This is the equivalent of two 7-cylinder engines combined in one unit acting on a double throw crankshaft.

As the result of the experience gained with this experimental model, Pratt & Whitney was convinced that the type was mechanically sound. Notwithstanding the encouraging results of the block and flight tests, it was considered essential, before proceeding with its further development to be definitely acquainted with the aerodynamic advantages of this type in various sizes and in different installations.

The results of the actual operation of the 2300 cubic inch engine, combined with those of the aerodynamic studies, made it clear that not only was the two-row type capable of considerably greater power outputs than were feasible with the single-row, but also that this higher power could be had with the added merits of smoother running, smaller drag in proportion to power and smaller diameter with consequent improvement in vision for the pilot.

Essentially, the two-row type uses a greater number of smaller cylinders than the single-row. Due to this and the resulting reduced reciprocating weights, it is possible to operate two-row engines at much higher crank speeds. The increased smoothness and reduced stress of the cylinder impulses provide for greater life.

The high crank speeds and the large powers of the two-row engines make reduction gearing desirable to obtain the best propeller efficiencies. A study was accordingly made by the United Aircraft & Transport Research Division of propeller conditions in airplanes for which the two-row engines were adapted, and this study led to a choice of gear ratios making possible good efficiencies with propellers of reasonable diameters and weights.

Subsequent flight testing has not only confirmed the expectations of airplane performance and fuel consumptions with the geared engines, but has also shown that the relatively low tip-speeds of the geared propellers make them distinctly quieter than direct-drive propellers. All these considerations re-

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sulted in a decision to offer only geared models of the two-row engines.

By the end of 1930, it was also obvious that the powers which could have been expected from a further development of the 2300 cubic inch engines were greater than those for which there were any immediate requirements. Rather than continue this development, The Pratt & Whitney Aircraft Company therefore undertook an 1830 cubic inch engine, the Twin Wasp, incorporating in its design the results of all the experience from the tests of the larger model. These 1830 cubic inch engines have been running continuously since early in 1931, not only for hundreds of hours of block testing, but also for long periods in flight.

It was decided from thorough study, however, that in addition to the Twin Wasp, a smaller engine was desirable for the immediate projects in hand. Accordingly in the early part of 1931, The Pratt & Whitney Aircraft Company began development of a smaller two-row engine, the Twin Wasp Junior.

A general description of one model of these two engines will serve for both, inasmuch as the design of each is substantially the same. To facilitate description, the power section will be dealt with first, followed by the rear section—which contains the supercharger and accessories—and finally the propeller section with its reduction gears.

The power section is built around a balanced two-throw crankshaft. The main crankcase, of aluminum alloy, is made in three sections and is split on the center line of each row of cylinders. The shaft is carried on three anti-friction bearings, one in each section of the case. Each crankpin carries a master connecting rod and six link rods. Each master rod is fitted with steel-backed lead-bronze bearings.

The link rods are secured to the master rod in the conventional manner and are lubricated under pressure at their inner ends. All rods are of "I" section, finished and polished all over as this construction provides for complete inspection of all surfaces. All rods are made of chrome-nickel-steel forgings.

The front and rear crankcase sections are provided with extensions which directly support the cams and valve tappets on either end. The cams are simple in construction, designed so that the gears may be ground for accuracy of manufacture. The cams are driven by spur reduction gears directly from the crankshaft, these gears being supported by bearings on either end in a manner which insures proper alignment at all times.

The valve tappets being carried in the same member as the cams, proper adjustment and alignment is assured. It is possible to assembly the entire power section and time the valves while

(*Concluded on page* 264)

The Aero-Sportswomen

by JOAN THOMAS

FAY GILLIS, who achieved fame as the first woman to join the Caterpillar club, has been in Russia for the past three years and it has been her good fortune to help speed several famous flyers on their way across Soviet territory.

Her latest adventure was to assist Wiley Post in his historic round-the-world flight by going to Novo-Sibirisk to arrange for the refueling of his plane. She spent three weeks in that far eastern outpost as Post's personal representative, where she arranged the local air administration and the Secretary of the district central executive committee to have everything ready to facilitate his arrival and departure.

According to recent dispatches she not only had them mow the grass on the landing field and set aside a special room for him to rest in at the airport, but she also worked out an Americanized menu for the meal that they had waiting for him on his arrival and then acted as his interpreter.

We received a long and interesting letter from Miss Gillis a few weeks ago which we would like to share at least in part, with our readers.

* * *

"Just received the last issue of the 'Ninety-Nine' bulletin this morning—Gee it made me homesick!" she wrote, "Clara reports there are 620 licensed women pilots—there were only a hundred and twenty when we started the Ninety-Nines four years ago this fall. It's a far cry from a hangar at Valley Stream to the St. Moritz in New York, but it was sure fun enroute. Only wish I could be more active in the gang but it is rather hard to do way over here—hope to make up for lost time when I get back home, which will probably be sometime this fall if things

Miss Fay Gillis who has had interesting experiences in Soviet, Russia.

work out according to Hoyle. He gives you the rules of the game but he isn't very good on advice in cases of emergency, so don't be too hard on me if I start for home and then get led astray enroute. Isn't life fun? It is just crammed full of unknown and fascinating byways—and I want to explore them all . . .

"Wish I could afford to buy a plane and make the world my landing field—no frantic searching for railroad tickets and catching trains by the tail-light—or don't you travel that way? Just fill the old ship with gas, take-off, cruise around until you see something that looks interesting, and if distance didn't lend too much enchantment, take time out to study the history and the people—then when you have delved into

(*Concluded on page* 273)

Miss Gillis (center) with a group of women pilots in the Soviet Air Forces. Laylu chnum Mamedbekova, the first Turkish woman pilot, stands second from the right.

Practical Lessons in Aviation

by JOHN B. RATHBUN

PART II

Balloons, which were the forerunners of the airplane, are supported by "aerostatic" forces due to the displacement of air by the light gases in the bag. In this section, we take up principles which are of present interest because of the stratospheric balloons and the coming Gordon-Bennett Balloon races.

WHILE bird-flight had been observed for thousands of years before man actually took to the air, it seems strange that the first flights were achieved by means of balloons or "aerostats" which are as unlike birds as anything that can be imagined.

Unlike the bird, the flight of a balloon is based upon the Principle of Archimedes, or upon "buoyancy" due to the forces generated by displacing air. No power is required, and such bodies will continue to float indefinitely without the expenditure of energy or fuel so long as the conditions remain unchanged. Within limits, this can be compared to a boat floating upon water, in which case, support is gained by the displacement of water.

To begin with, Archimedes' Law states that: "Every body, which is immersed in a fluid, is acted upon by an upward force equal to the weight of the fluid displaced by the immersed body." In other words, if the body occupies 100 cubic feet of space and therefore displaces 100 cubic feet of air, then the lifting force developed will be equal to: $100 \times 0.07651 = 7.651$ pounds, where the weight of standard air is taken at 0.07651 pound. If the body weighs more than 7.651 pound it will not rise. If it is exactly equal to the weight of the air displaced, it will float in stable equilibrium with no tendency to either rise nor descend.

This can be stated in another way. "If the density of the immersed body is equal to the density of the fluid (air), then the body will float in equilibrium." If the density of the balloon is less than the density of the surrounding air, the balloon will continue to rise until an altitude is reached at which the decreased air density becomes equal to the density of the body. At this latter point it will stop.

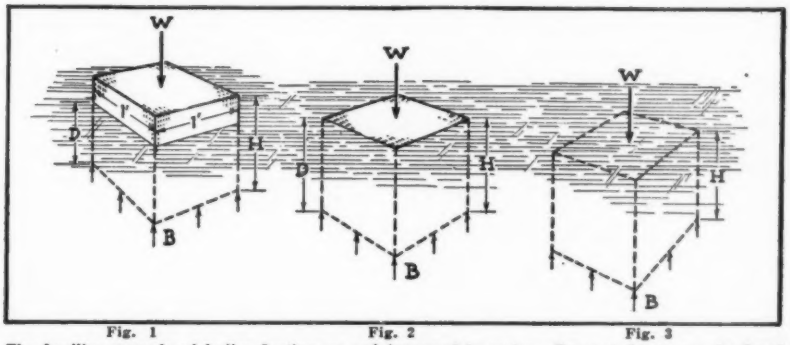


Fig. 1 Fig. 2 Fig. 3

The familiar example of bodies floating on and immersed in water. Buoyant forces are developed by the displacement of water.

In Fig. 1, we have a body partly submerged and floating in water. According to the law, the immersed portion (D) must displace a weight of water equal to the weight (W) of the body. The supporting forces (B) are clearly due to the upward pressure of the water on the bottom of the body acting against the weight (W) of the body.

Since it is only necessary, in this case, to immerse part of the body to gain the necessary support, it is at once evident that the density of the whole body is less than that of the water. The weight of the water is proportional to the column height (D), but the mass of the body is the greater amount (H), indicating a greater body volume for the same weight or lower density.

In Fig. 2, the body floats with its top flush with the surface of the water, hence in this case, the density of the body must be exactly equal to the density of the water. The depth of immersion (D) is now equal to the body height (H). Taking the density of water at 62.3 pounds per cubic foot, the density of the body must also be 62.3 pounds per cubic foot.

Now, the cases in Fig. 1-2 are not exactly equivalent to a balloon floating in air, for there is no surface discontinuity in the air as between water and air, therefore the balloon is always completely immersed in the fluid as in Fig. 3. In this figure, the body is subjected to two forces, the upward force or lifting force (B) caused by the displaced water and the second downward force (W) due to the weight of the body.

If (W) is equal to (B), the body will float at equilibrium in any part of the fluid where it may be placed and without any tendency to move. If (B) exceeds (W), then it will rise until (W) and (B) are once more in equilibrium. If (W) exceeds (B), the body will sink.

And now we get to the point where we can compare the case of the spherical balloon in Fig. 4 with the submerged weight in Fig. 3. The gas bag of the balloon is filled with a gas lighter than air to reduce its density, and this produces the buoyant force (B) which acts against the weight (W).

Gases such as hydrogen or helium are most commonly used in filling the bag. Air, when strongly heated, is also much lighter than the cooler atmospheric air and has been used extensively in the old "hot-air" circus balloons or "Montgolfiers" as they were formerly known. Coal gas or illuminating gas are only used occasionally.

There is a very simple formula for this calculation that gives "gross" buoyant force where the weight of the bag, load and passengers are neglected.

$B = V \times (D - d)$

(B) is the buoyant force, (V) is the air displacement volume in cubic feet, (D) is the density of the air (0.07651)

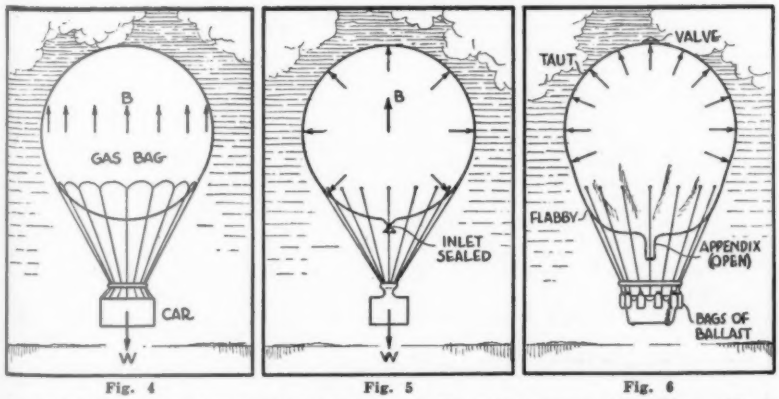


Fig. 4 Fig. 5 Fig. 6

At the left is an elementary aerostat or balloon. In Fig. 5 is a pressure type balloon while in Fig. 6 is the more common type of flaccid or "flabby" balloon.

and (d) is the density of the gas used in the bag. The density of ordinary balloon gases are given in the following table:

PROPERTIES OF BALLOON GASES

Name of Gases	*Density Lbs./Cu.-Ft.*
Pure hydrogen	0.00561
Commercial hydrogen	0.00650
Helium, pure	0.01114
Coal gas, average	0.03151
Hot air (400° F.)	0.04800

Thus, we see that pure hydrogen gas is by far the best, but it is dangerous because of its combustible qualities. Commercial hydrogen carries some impurities, and as all gas is diluted by air after standing in the balloon, we cannot safely use the lifting value of pure hydrogen for the actual design. The lifting power of coal gas or illuminating gas is limited and requires, therefore, an excessively large envelope for a given load carrying capacity.

By the use of the simple formula given here, the lifting or buoyant force (B) for commercial hydrogen and a bag capacity of 35,000 cubic feet can be computed as follows:

$B = V \times (D - d) = 35{,}000 \times (0.07651 - 0.0065) = 2{,}450$ pounds. Now, be it understood, this is the "gross" lifting power of hydrogen alone without regard to the dead weight of the balloon or the passengers, and is assumed at sea-level standard conditions. At higher altitudes, where the air density is reduced or at temperatures above or below 60° F., there will be a marked difference in the results.

Just as an example of what the dead weights amount to, I will quote the specifications of a standard 35,000 cubic foot spherical hydrogen balloon made by Goodyear.

35,000 CUBIC FOOT SPHERICAL BALLOON

(*Using 85 per cent hydrogen*)

Capacity of envelope	35,000 cu. ft.
Diameter of bag	41 ft.
Carrying capacity, persons	5
Gross lift, or buoyant force	2,240 lbs.
Weight of balloon	690 lbs.
Disposable lift for passengers, ballast, supplies, instruments, etc.	1,550 lbs.
Weight of passengers, 5@ 160 lbs.	800 lbs.
Instruments	75 lbs.
Drag rope	50 lbs.
Food, supplies, etc	50 lbs.
Total useful load	975 lbs.
Difference for ballast	575 lbs.

It should be noted that a considerable percentage of the load consists of ballast in the form of sand or water as the ascent of the balloon is controlled by throwing ballast overboard when it is desired to increase the altitude. The greater the percentage of ballast, as a rule, the greater will be the duration of the flight.

Probably the smallest practicable single passenger balloon is the 9,000 cubic foot type of which the following are the specifications:

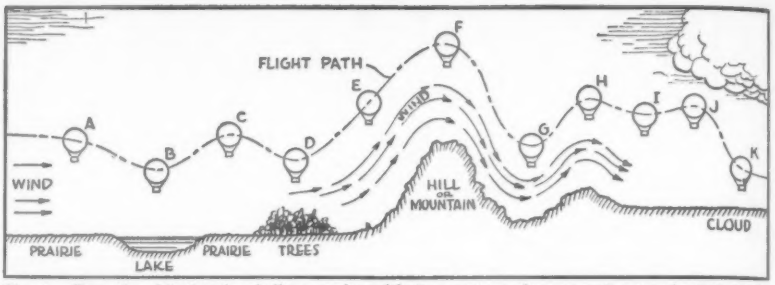


Fig. 7. How the altitude of a balloon varies with temperature changes and natural vertical air-currents when allowed to float without control by valving or ballast discharge.

9,000 CUBIC FOOT SPHERICAL BALLOON

Capacity of envelope	9,000 cu. ft.
Diameter of envelope	26 ft.
Carrying capacity, persons	1
Gross lift or buoyant force	576 lbs.
Weight of balloon	330 lbs.
Disposable lift	246 lbs.

This shows how a comparatively small decrease in the diameter of the bag will greatly decrease both the gross lift and disposable load, for the capacity of the envelope for gas varies as the "cube" of the diameter. Thus, the diameter of the 35,000 cubic foot balloon is only about 50 per cent greater than the 9,000 cubic foot type, yet this produces an increase of about 400 per cent in the gross lift and 600 per cent in the disposable lift.

SUMMARY OF IMPORTANT FACTS

1. **The atmospheric air has weight and density, hence can support bodies of equal or less density, according to the Law of Archimedes.**
2. **Archimedes Law states: "Every body immersed in a fluid is acted upon by an upward force equal to the weight of the fluid displaced by the immersed body."**
3. **If the density of the immersed body is less than that of the fluid, the body will float.**
4. **If the density of the body is equal to that of the fluid it will remain in equilibrium at any point in the fluid.**
5. **To maintain a low density, the balloon is filled with such light gases as hydrogen, helium, coal gas or warm air.**
6. **The density of pure hydrogen, sea-level pressure, is 0.00561 pound per cubic foot at 60° F.**
7. **The gross lifting or buoyant force is equal to the difference between the density of the gas and the density of the air, this being multiplied by the volume of gas.**
8. **At high altitudes, where the density of the air is reduced, the lift is also reduced below that at sea-level.**
9. **Increased gas temperature gives increased lifting effect.**
10. **Increased air temperature reduces lift.**
11. **Humidity slightly decreases the lift.**
12. **Impure gas reduces lift in proportion to the percentage of impurities.**

TYPES OF SPHERICAL BALLOONS

Generally speaking, there are two types of spherical balloon, the pressure type in which all of the gas in the envelope is above atmospheric pressure, and the "flabby" or "flaccid" balloon that is filled at atmospheric pressure. The toy rubber balloon is an example of the pressure type and likewise the non-rigid dirigible falls under this head. The average passenger carrying spherical balloon, however, is of the flabby type, filled at atmospheric pressure.

Fig. 5 shows a pressure type balloon in which the arrows indicate that the gas pressure is exerted all over the surface, placing the fabric under tension at all points. The great trouble with this type is that the density of the gas is increased, hence its lifting effect is not as great as when at atmospheric pressure. Further, the pressure unduly stresses the envelope. Pressure increases the density of any gas, but in non-rigid dirigibles this is admissible since some pressure is necessary to maintain the streamline shape of the envelope.

Fig. 6 shows the flabby balloon filled at atmospheric pressure. The pressure in the upper half of the bag is slightly above atmospheric pressure due to the fact that the light gas rises to the top of the bag. The lower half is flabby or slack because it is filled with gas at atmospheric pressure, the pressure being equal on both sides of the envelope.

Ordinarily, the bottom of the envelope is open to the atmosphere through the "appendix," and when expansion takes place due to the lower air pressures at high altitudes, or increased temperature, the pressure is released by the excess gas escaping through the appendix.

Unless otherwise specified, our balloon calculations will refer to the flabby balloon where the gas and air are at approximately the same pressure.

CONTROL OF SPHERICAL BALLOONS

Only a limited control is had over a spherical balloon in flight because the balloon must necessarily drift with the

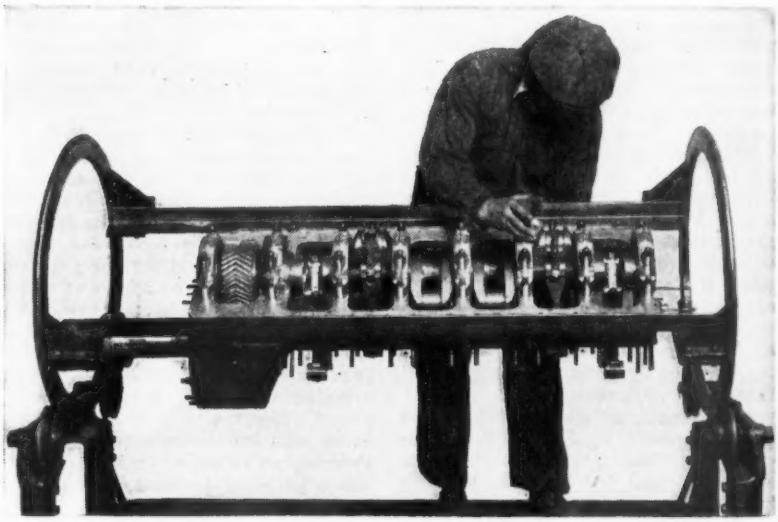
(*Concluded on page 274*)

Aero Engine Maintenance

by

ERNEST FAIR

This well known authority on aeronautic engine maintenance and repair gives many valuable tips to the private owner who services his own plane.



Showing the convenience of the tilting stand when employed for working on an aeronautic engine.

PRIVATE flyers should constantly seek added life for their engines by paying proper attention to overhauls.

In the hands of the mechanic who performs repairs and overhauls rests the future successful operation of any engine as well as the total length of its service life. The precautions he exercises and the thoroughness with which the job is done are of extreme importance. In the paragraphs to follow, the writer presents from the notes he has made over a period of more than five years.

Cleanliness is the first precaution. Before beginning any repairs or work on the engine, the plane should be placed on a clean protected spot and should be thoroughly washed with gasoline before any disassembly is made. Dust and dirt wear out many engines before their time.

Each part should be washed in gasoline and then placed on an inspection bench, either a stationary or rolling type but placed close at hand. Plenty of light should always be present. Drop lights are very handy while inspecting cylinder bores and valve seats. Bearings should be smeared with clean engine oil when the parts are being put together. All parts should be inspected for slight burrs or nicks that may have resulted from rough handling or other accidental causes. If any such are found they should be removed before assembly.

Removing the valve cages from air-cooled cylinders. Note the small tilting stand that has been a great convenience for this work.

For convenience in assembly as well as disassembly it is advisable to place the engine on a tilted stand. The engine should then be tilted to a position where the crankshaft is vertical. Engine parts should be properly arranged on the bench or in trays as removed. This insures against rough treatment and facilitates perfect re-assembly in proper sequence.

Overhauls can often be performed without removing the engine but where stands are available it is always wise to remove the engine and work on it from a stand. When it is only necessary to examine the master rod or crankshaft, the blower and rear sections of the engine can remain on the plane while the nose and main section of the case on some engines can be removed as a unit.

After the cowling has been removed, the engine should be thoroughly washed with gasoline. Clean tins and boxes should be provided for small parts and everything set in order. Never perform a complete disassembly without the proper tools at hand and a clear understanding of exactly what is to be done. It is well to have the complete tool sets and instrument books provided by engine manufacturers on hand. In the larger shops mechanics are encouraged to study and understand a single type of engine and work on it exclusively, but in the smaller shops this is not possible so that it is advisable to keep a file of information on all types of aircraft engines at hand.

If the engine is to stand for any length of time before use, all steel parts, both inside and out, should be covered with oil to prevent rust. When

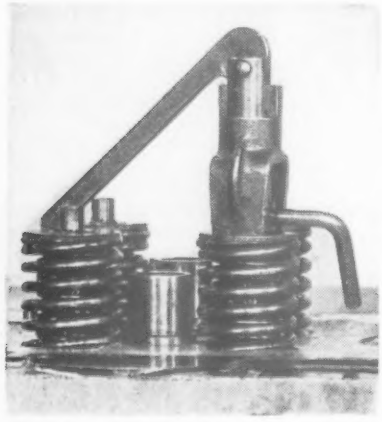
it is to be taken out of service and put in storage the old oil should be drained and about one pint of clean engine oil should be placed in each cylinder. The crankshaft should then be turned several revolutions to make sure the cylinder walls are well covered. Spark-plug holes should be closed either with plugs or corks. Oil the valve rockers, carbureter throttle shaft and magnetoes as well as all external bright metal parts.

The effect of poor oil on the life of an engine is an important thing to note. Low grade oils may cause serious engine troubles. In freezing weather, the oil in the lubricating system should be drained out immediately after flight while the engine is still warm if the engine is to stand for some time. When making ready for flight the oil should be heated to at least 150° F. before placing it in the tank. The engine will then start much easier.

A noticeable reduction in engine speed on the ground at full throttle generally indicates the need of adjustments or top overhaul, but it should be borne in mind that extremes in temperature or barometer due either to atmospheric condition or altitude will also affect propeller speed as much as 50 to 300 r.p.m.

Never use kerosine or any type of flushing fluid inside the engine. If it is desirable to flush the system do so with fresh engine oil only. Some manufacturers advise the washing of the interior of the engine—certain parts only, bear in mind—with gasoline before oiling Before assembly, parts should be thoroughly cleaned and free of grit after wiping with a clean dry rag free from lint. The use of waste or tattered rags, pieces of which might remain inside the engine unnoticed and clog up pipes or strainers, is advised against.

All studs, nuts and parts which are a drive fit should receive a coat of oil. Where there is a possibility of oil leaking out between two machined surfaces, as under the cylinder hold down flanges, the surfaces should be coated with soft soap before assembly.



Removing the valve springs by a special tool saves time and damage.

A fibre drift should be used when it is necessary to separate or drive parts together. Considerable damage may result otherwise. Attempts to drive valve guides out with a drift, however, are liable to end in their seizure in the bosses, necessitating replacement with oversized parts. In removing valves, the use of a block of wood rounded on the upper end to fit the cylinder dome is advisable.

In using this and all other tools and handy accessories about the engine it is important that they be clean as cylinder barrels may be easily marred by chips or dirt. When the cylinder is placed over the block, the valves will be held shut and the valve springs can be easily removed by use of a special valve spring compressor tool. Rocker arms should seldom be removed.

Excessive carbon should be removed from the cylinder heads before valve grinding is begun. It should be removed from the cylinder side of the valve with particular attention being exercised so as not to mar valve seats. Valve grinding compounds should be kept away from valve guides and cylinder bores. After it has been completed, the parts should be thoroughly cleaned and valve stems oiled before reassembling. The same treatment should be applied to rocker balls, push-rod balls and rocker-arm bearings.

Care should be taken so that the piston does not swing over against either of the adjacent cylinders and that rods or rocker arm cups do not fall out of their housings. As soon as the cylinder is removed, the piston should be taken off to avoid injury in subsequent operations. Never slack off on a nut to line up the notch in the nut with the cotter pin hole in the bolt or stud. If it cannot be tightened sufficiently, with reasonable effort, the nut should be replaced.

Cotter pins and safety wires which have been badly bent should be discarded. Extreme care should be taken to prevent dirt, dust, cotter-pins, lock wires, nuts, washers and other small parts from falling into the inside of the engine. They will eventually work into gears or oil lines and cause considerable damage.

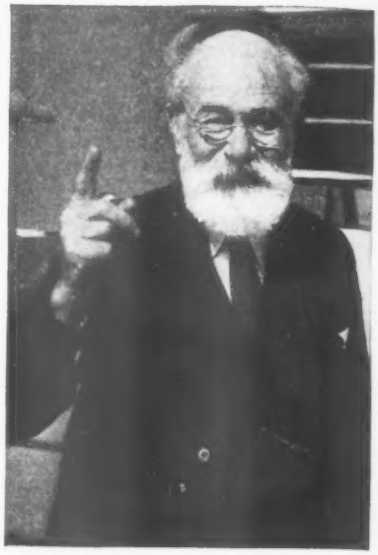
After a new engine has been unpacked and cleaned, or after an old one has been repaired and is ready for installation, all burrs and sharp corners should be removed from the engine mount and mounting flange. The mount should be flat and form a close fit to the mounting flange. The engine should be hoisted by the lifting eyes and carefully worked at the rear end of the mounting ring.

Care, caution, cleanliness — these things prolong the life of an aircraft motor. Each is as important as the other. The disregard of any single one will nullify exercise of all others.

After the reassembly comes the test run which should be as thorough and searching as the adjustments.

END.

The World's Oldest Licensed Pilot



Mr. Charles Dickinson tells of his air mail project.

FOR many years, Charles Dickinson, Chicago, Ill., has been conspicuous in Chicago aeronautical affairs. He has been flying for 22 years, and although his age is 75 years, he is now planning a trans-Pacific flight.

He recently started for the Orient aboard the Dollar Liner President Coolidge, which is his sixth trip in 16 months to complete plans for a non-stop flight back to the United States. Seattle will be his objective. He does not say whether he will pilot the plane himself nor will he give any details as to its nature at present.

Mr. Dickinson is a prominent business man and was president of the Aero Club of Illinois for several terms. Many years ago he organized an airmail line, and it is said that he intends to push an application for an airmail subsidy should his trans-Pacific flight prove successful.

Slim Waistline Saves Life

JACKIE BROWN, 95-pound Los Angeles parachute jumper, had a new argument in favor of slim waistlines a short while ago, for her slim waist probably saved her life.

Jackie bailed out of her ship for an exhibition jump, intending to slip her parachute eastward to land on the airport. Instead she dropped straight down toward a high-tension electric power line.

After struggling for several hundred feet to guide the parachute off the line, the girl stiffened, closed her eyes, and waited. She slid between the wires and the folds of the 'chute settled down over them. Power men said if she had closed the circuit between the two wires that she would have been electrocuted.

How to Locate the Wings

by VERNON W. PAYNE

A full description of how the center of pressure on the wings is brought into proper agreement with the center of gravity, solving the problem of instability with the low-wing monoplane.

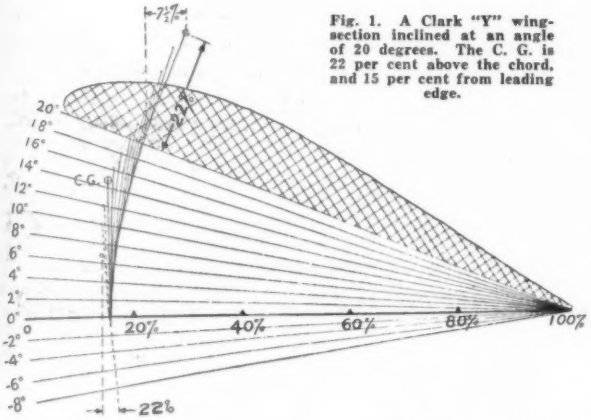


Fig. 1. A Clark "Y" wing-section inclined at an angle of 20 degrees. The C. G. is 22 per cent above the chord, and 15 per cent from leading edge.

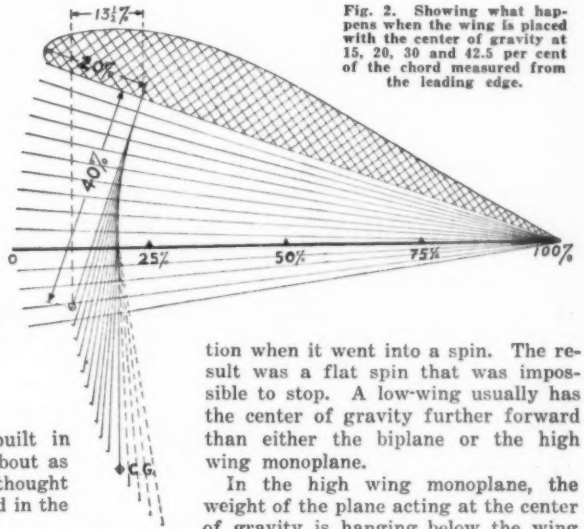


Fig. 2. Showing what happens when the wing is placed with the center of gravity at 15, 20, 30 and 42.5 per cent of the chord measured from the leading edge.

WHERE should we put the wings on the airplane and why? That is a big question to answer and it is no wonder that when you asked an old timer he would say, "Oh, at about 30 percent of the chord."

What he meant was that the center of gravity of the airplane should be placed so that it was located about 30 percent of the wing chord measured back from the leading edge. For example, if our wing has a 100 inch chord then 30 percent would be 30 inches back from the leading edge.

That answer partly satisfied the question before we started to build low-wing monoplanes and it saved a lot of breath. Some low-wing monoplanes have been built in the past with just about as much reasoning or thought to the subject as used in the above answer.

You know what the result was. Many of the low-wings, so designed, have landed in one compact heap. It seems that there is a tendency for young designers and builders to steer clear of the low-wing because of these many mishaps to others.

A low-wing, properly designed, can be as safe as any other type of airplane. Many of the low-wings that were not successful had the center of gravity too far back from the leading edge of the wing, which had a tendency to hold the airplane in a stalled position when it went into a spin. The result was a flat spin that was impossible to stop. A low-wing usually has the center of gravity further forward than either the biplane or the high wing monoplane.

In the high wing monoplane, the weight of the plane acting at the center of gravity is hanging below the wing and acts like a pendulum.

When the wing is level, the weight of the ship is hanging straight below it. As soon as the wing is tilted up or down, the weight will tend to return to its original position, thereby bringing the wing back to the level position. In a mid-wing, pendulum action is absent. The low-wing appears to be top heavy because the weight is above the wing.

The big worry in this problem is the fact that the center of pressure moves and is at a different place for every

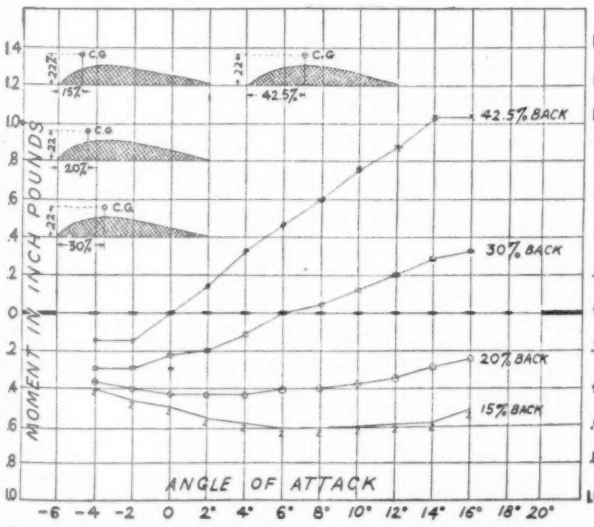


Fig. 3. Graph showing the C. G. at 15 per cent back from the leading edge, a good location for a low-wing plane.

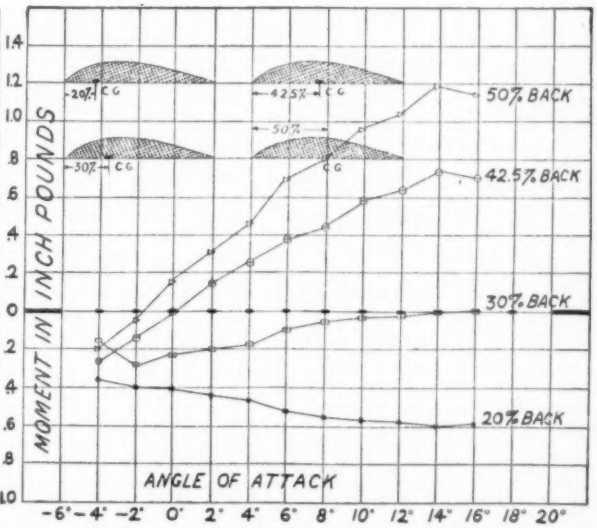


Fig. 4. Showing that the center of gravity on the chord line and at four locations from leading edge.

angle of attack. In a low-wing ship we must place the center of gravity far enough forward so that at all practical angles of attack the ship has a tendency to dive. This is part of our insurance against a flat spin. Some wings can be made to balance at all low angles but will dive out of a stalled position. This is a desirable condition.

There are two general types of wing sections—the stable and the unstable. The N.A.C.A.-M6 is a stable type while the Clark "Y" is an example of the unstable wing. The majority of ships today use a wing of the unstable type. The center of pressure moves toward the leading edge of the wing on the stable type and in the opposite direction with an unstable wing when the angle of attack is decreased. Because of this difference in the movement of the center of pressure, the center of gravity has to be placed at a different place for either of the two types of wings.

As most lightplanes of today use a Clark "Y" or some other unstable type of wing section, we will investigate the Clark "Y" which will give you a fair idea of the problem of placing the wings in relation to the center of gravity of the ship. We will demonstrate the idea on a low-wing, a mid-wing and a high-wing monoplane. Locating the wings on a biplane is an art and is more difficult to explain.

Fig. 1 is a sketch of a Clark "Y" section inclined at 20 degrees. Slanting lines show the position at lower angles including 6 degrees. This drawing shows the center of gravity (C.G.) at 22 percent above the chord line and 15 percent back from the leading edge (L.E.). Example: With a wing of 100 inch chord, the C.G. is 22 inches up from the chord line and 15 inches back from the L.E.

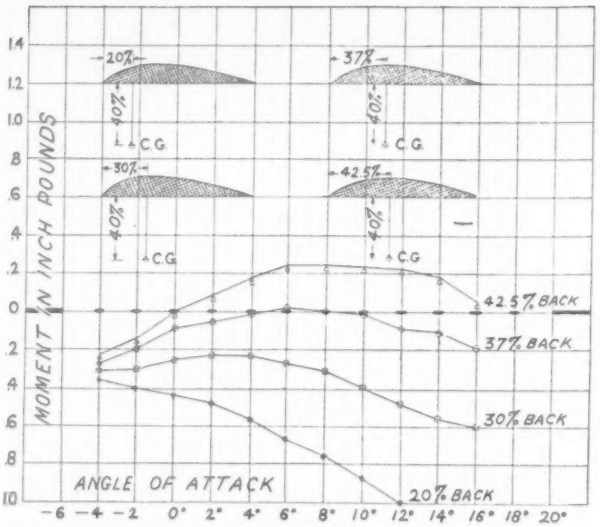


Fig. 5. Graph showing why a high-wing or parasol type monoplane has been safe because of pendulum action.

Notice that, when the wing is at a negative angle of attack, the center of gravity has moved forward and then moves back when the angle is made positive or moved above the 0 degree angle. In Fig. 1 we also show at the 20 degree angle (with dotted lines), how to measure the distance that the center of gravity has moved back. The amount of movement is 7½ per cent, or 7½ inches on a hundred inch chord wing at a 20 degree angle of attack.

In Table 1, Col. 2, is shown the position of the center of gravity (C.G.), at all practical angles of attack. In Col. 3 is shown the position of the section at all practical angles. In Col. 4 is the difference between the C.G. and the C.P. locations. This is all in percentages of the chord.

Now that we are investigating a model airfoil or wing which has a chord of 3 inches and a span of 18 inches, tested at a velocity of 40 m.p.h., we will change these percentage readings to inches. This is done in Col. 5 by multiplying the readings in Col. 4 by the wing chord of 3 inches. Call this the "lever-arm."

Oftentimes we speak of a crowbar as a lever and the longer the handle, the greater is the leverage. Similarly the greater the distance of the C.P. from the C.G., the greater tendency of the wing to stall or dive, depending on whether the C. P. is ahead or behind the C. G. Remember that the center of pressure is acting upwards and the center of gravity is acting down.

In Col. 6, Table 1, we have the Ky or constant of lift at one mile an hour for all practical angles when using a Clark "Y" wing section. In Col. 7, we have the lift which is found by using the formula: $Lift = KySV^2$. The Ky

TABLE 1. C. P. and C. G. MOVEMENT

CLARK Y WING SECTION C. G. = 22% Above and 15% Back								CLARK Y C. G. = 22% Above and 20% Back				CLARK Y C. G. = 22% Above and 30% Back				CLARK Y C. G. = 22% Above and 42½% Back			
No. 1 Angle	No. 2 C. G. Movement	No. 3 C. P. Mov't.	No. 4 Diff. C. G. and C. P.	No. 5 Lever Arm	No. 6 Ky	No. 7 Lift Lb.	No. 8 M. I.	C. G. Movement	Diff. C. G. and C. P.	Lever Arm	M. I.	C. G. Movement	Diff. C. G. and C. P.	Lever Arm	M. I.	C. G. Movement	Diff. C. G. and C. P.	Lever Arm	M. I.
−4°	1½ −15=13½	95.	81.5	2.45″	.000256	154	−.375	1½ −20=18½	76.5	2.3″	−.352	1½ −30=28½	66.5	1.995″	−.306	1½ −42½=41	54.	1.62″	−.149
−2°	¾ −15=14¼	55.	40.75	1.22″	.00064	.384	−.469	¾ −20=19¼	35.75	1.07″	−.412	¾ −30=29¼	25.75	.773″	−.297	¾ −42½=41¾	13.25	.398″	−.153
0	15	42.5	27.5	.83″	.00102	.612	−.505	20	22.5	.675″	−.413	30	12.5	.375″	−.23	42½	0	.425″	0
2°	¾ +15=15¾	38.	22.25	.67″	.0014	.844	−.563	¾ +20=20¾	17.25	.518″	−.436	¾ +30=30¾	7.25	.218″	−.184	¾ +42½=43¼	5.25	.158″	−.133
4°	1½ +15=16½	35.	18.5	.56″	.00176	1.06	−.588	1½ +20=21½	13.5	.405″	−.429	1½ +30=31½	3.5	.105″	−.111	1½ +42½=44	9.	.27″	−.324
6°	2⅛ +15=17⅛	33.	15.7	.47″	.00222	1.33	−.628	2⅛ +20=22⅛	10.7	.321″	−.428	2⅛ +30=32⅛	1	.021″	−.028	2⅛ +42½=44⅝	11.8	.354″	−.472
8°	3 +15=18	32.	14.	.42″	.00243	1.46	−.612	3 +20=23	9.	.27″	−.394	3 +30=33	1.	.03″	.044	3 +42½=45½	13.5	.405″	−.59
10°	3⅜ +15=18⅜	31.	12.4	.37″	.00276	1.66	−.616	3⅜ +20=23⅜	7.4	.22″	−.366	3⅜ +30=33⅜	2.6	.078″	.129	3⅜ +42½=46⅛	15.1	.453″	−.747
12°	4½ +15=19½	30.5	11.	.33″	.00299	1.79	−.592	4½ +20=24½	6.	.18″	−.323	4½ +30=34½	4.	.12″	.215	4½ +42½=47	16.5	.495″	−.877
14°	5⅛ +15=20⅛	30.	9.9	.30″	.00324	1.95	−.578	5⅛ +20=25⅛	4.9	.147″	−.286	5⅛ +30=35⅛	5.1	.153″	.298	5⅛ +42½=47⅝	17.6	.528″	1.034
16°	6 +15=21	30.	9.	.27″	.00312	1.87	−.505	6 +20=26	4.	.12″	−.225	6 +30=36	6.	.18″	.337	6 +42½=48½	18.5	.555″	1.037

in this formula is taken from Col. 6. The "S" represents the wing surface area the "V2" is the velocity squared. The wing area is equal to 18 inches (span) times 3 inches (chord) or 54 square inches. The velocity is 40 miles per hour.

Example: at 8 degrees, the Ky is .00243 and the wing area is 54 square inches, but it must be changed to 0.375 square feet. Now the formula for lift says to multiply the "Ky" by the "S" and then multiply the result by the square of the velocity or .00243 x .375 x 40^2 equals 1.458 pounds.

In Col. 8, we multiplied the lift in Col. 7 by the lever arm in Vol. 5. The result is the "moment of inertia," (M.I.). From the results in Col. 8 we can draw a curve as in Fig. 3. The curves in Fig. 3 show us what happens when the wing is placed with the center of gravity at 15, 20, 30 and 42.5 percent of the chord, measured back from the leading edge.

This may seem complicated but you need only to study the curves to get a summary of the work done and tabulated in this article. The three charts show four different positions of the center of gravity for each of the low-wing, mid-wing and the high-wing types of monoplanes.

When the curve starts near the bottom left hand corner and extends toward the top right hand corner, it is said to have a stalling slope. The opposite direction is spoken of as having a diving slope. It is desirable to produce a combination that will have a diving slope or at least a zero slope.

If the curve is tilted up at the right hand end, but is still below the zero line, it is still causing a diving movement on the wing, but to a smaller amount at the higher angles of attack.

In Fig. 3, the curve showing the C.G. at 15 percent, back from the leading edge, is a good location for a low-wing. The 20 percent, is also fair since both positions are below the zero line and at all angles of attack they cause the wing to dive. A smaller tail could be used with the C.G. at the 15 percent position than at the 20 percent. The C.G. at 30 percent, shows that the wing balances at 6.5 degrees and at 16 degrees causes a stalling action. If this position were used, a large tail would be needed to overcome this stalling tendency at 16 degrees. At 42.5 percent back from the leading edge, the stalling tendency is too great.

In Fig. 4, the curves show the center of gravity on the chord line and at four different locations measured from the leading edge. The curve with the C.G. at 20 percent, shows a diving slope all the way to 16 degrees. The curve with the C.G. at 30 percent is not bad, it balances at the 14 and 16 degree angles, which means it neither causes a stall nor dives at these high angles. The proper size tail will take care of this. The curves for the 42.5 and 50 percent locations show large stalling slopes at the large angles.

(*Continued on page* 273)

TABLE 2. VARIOUS C. P. DATA ON CLARK "Y" WING

CLARK Y C.G.=On Chord Line & 20% Back				CLARK Y C. G.=On Chord Line & 30% Back				CLARK Y C.G.=On Chord Line & 42½% Back				CLARK Y C.G.=On Chord Line & 50% Back			
C.G. Location	Diff. C.G. & C.P.	Lever Arm	M.I.	C.G. Location	Diff. C.G. & C.P.	Lever Arm	M.I.	C.G. Location	Diff. C.G. & C.P.	Lever Arm	M.I.	C.G. Location	Diff. C.G. & C.P.	Lever Arm	M.I.
−4° 20%	75%	2.25 in.	−.345	30%	35%	1.05 in.	−.1612	42½%	52.5%	1.57 in.	−.242	50%	45%	1.35 in.	−.207
−2° 20	35	1.05 in.	−.403	30	25	.75 in.	−.288	42½	12.5	.375 in.	−.143	50	5	.15 in.	−.058
0° 20	22.5	6.75 in.	−.413	30	12.5	.375 in.	−.229	42½	0	0 in.	0	50	7.5	.225 in.	.138
2° 20	18	.54 in.	−.456	30	8.	.24 in.	−.203	42½	4.5	.135 in.	.114	50	12	.36 in.	.304
4° 20	15	.45 in.	−.477	30	5.	.15 in.	−.159	42½	7.5	.225 in.	.238	50	15	.45 in.	.476
6° 20	13	.39 in.	−.520	30	3.	.09 in.	−.12	42½	9.5	.285 in.	.380	50	17	.51 in.	.680
8° 20	12	.36 in.	−.525	30	2.	.06 in.	−.088	42½	10.5	.315 in.	.459	50	18	.54 in.	.801
10° 20	11	.33 in.	−.547	30	1.	.03 in.	−.05	42½	11.5	.345 in.	.571	50	19	.57 in.	.946
12° 20	10.5	.315 in.	−.565	30	.5	.015 in.	−.027	42½	12.	.36 in.	.646	50	19.5	.585 in.	1.05
14° 20	10	.3 in.	−.584	30	0	0 in.	0	42½	12.5	.375 in.	.730	50	20	.6 in.	1.17
16° 20	10	.3 in.	−.562	30	0	0 in.	0	42½	12.5	.375 in.	.702	50	20	.6 in.	1.123

TABLE 3. C. P. and C. G. MOVEMENT

CLARK Y C. G. = 40% Below and 20% Back				CLARK Y C. G. = 40% Below and 30% Back				CLARK Y C. G. = 40% Below and 37% Back				CLARK Y C. G. = 40% Below and 42.5% Back			
C. G. Movement	Diff. C. G. and C. P.	Lever Arm	M. I.	C. G. Movement	Diff. C. G. and C. P.	Lever Arm	M. I.	C. G. Movement	Diff. C. G. and C. P.	Lever Arm	M. I.	C. G. Movement	Diff. C. G. and C. P.	Lever Arm	M. I.
−4° 21¼+20=22¼	72.25	2.167″	− .333	21¼+30=32¼	62.75	1.88″	− .289	21¼+37=39¼	55.75	1.67″	− .257	21¼+42½=45	50.25	1.51″	− .231
−2° 1 +20=21	34.	1.02″	− .392	1 +30=31	24.	.72″	− .287	1 +37=38	17.	″	− .196	1 +42½=43½	11.5	.345″	− .133
0° 20	22.5	.675″	− .413	30	12.5	.375″	− .23	37	5.5	″	− .101	42½	0	0	0
2° 1 −20=19	19.	.57″	− .481	1 −30=29	9.	.27″	− .228	1 −37=36	2.	″	− .051	1 −42½=41½	3.5	.105″	.088
4° 21¼−20=17¾	17.25	.517″	− .548	21¼−30=27¾	7.25	.217″	− .230	21¼−37=34¾	.25	″	− .008	21¼−42½=40¼	5.25	.158″	.166
6° 3¾−20=16¼	16.75	.502″	− .668	3¾−30=26¼	6.75	.203″	− .270	3¾−37=33¼	.25	″	.01	3¾−42½=	5.75	.172″	.229
8° 5 −20=15	17.	.51″	− .745	5 −30=25	7.	.21″	− .306	5 −37=32	0	″	0	5 −42½=	5.5	.165″	.241
10° 6½−20=13½	17.5	.525″	− .872	6½−30=23.5	7.5	.225″	− .373	6½−37=30½	.5	″	− .025	6½−42½=	5.	.15″	.248
12° 8 −20=12	18.5	.555″	− .996	8 −30=22	8.5	.255″	− .459	8 −37=29	1.5	″	− .081	8 −42½=	4.	.12″	.216
14° 9½−20=10½	19.5	.59″	−1.14	9½−30=20½	9.5	.285″	− .555	9½−37=27½	2.5	″	− .116	9½−42½=	3.	.09″	.175
16°10½−20= 9½	20.5	.62″	−1.151	10½−30=19½	10.5	.315″	− .59	10½−37= 26½	3.5	″	− .197	10½−42½=	1.	.03″	.056

Aviation in Future Years

by ALFRED BROWNE

Scientists tell us that future airways will lie in the stratosphere and that the rocket type of ship, or levitator will be the ultimate craft. If speeds of 1,000 miles per hour are to be attained, then this will be necessary.

FUTURISTIC and improbable as the idea may sound to us, Dr. Theodor von Karman, director of the Guggenheim Graduate School of Aeronautics, stated that the development of a plane capable of making 1,000 miles an hour is not impossible.

Of all industries, aviation depends perhaps more on the scientist for its continued development than any other. With the scientific worker, first comes the hypothesis, to be followed by experiments to prove its worth, further its practical application—and ultimately we benefit.

So it is with interest we "listen in" on the physicists of the California Institute of Technology as they consider the problems confronting the development of such a plane. For here preliminary experiments on basic laws involved in the construction of such an airplane will soon be underway.

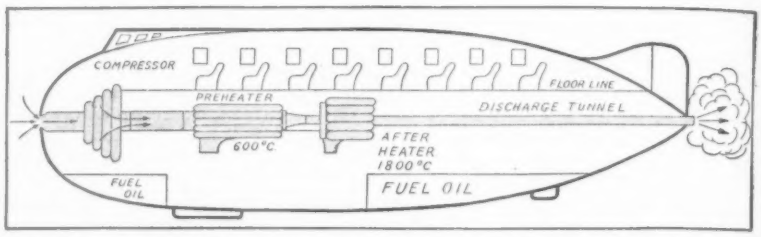
That the work of these men proves practical is shown in the recent opening of a laboratory at Akron, Ohio, where research work will be conducted to further the progress of such lighter-than-air craft as the great "Macon"—with one eye on the commercial possibilities.

Here Dr. Robert A. Milliken was quoted as saying: "This type of ship is the only commercially practical means for trans-oceanic air flight." The gas-bag type of ship was said to be able to carry a heavy pay-load a much greater distance than can airplanes of today . . . But with a plane developed that can fly from New York to a chosen spot in Europe in only three hours! . . . Ah! There will be a different tale to tell!

Dr. Arthur A. Klein, professor of aeronautics declared that, due to the high state of perfection of modern airplanes, a radical change in construction would be necessary to obtain the greater speed without reducing the carrying capacity, or "pay-load" of the plane.

But, because of the present perfection in building of airplanes, which represent a well-balanced structure, securing the greatest efficiency from each co-efficient when considered as a part of the whole, one thing cannot be further developed without throwing the entire structural formation out, thus necessitating changes all down the line.

Drag, or air-resistance of the airplane, for example, can be reduced 60 percent, according to Dr. Klein. This would increase the air-speed 20 percent—but at the cost of reduced pay-load capacity. So we turn to different methods of motivation, such as an internal combustion engine.



Longitudinal section through the proposed compressed air rocket ship, not unlike the type recently suggested by J. B. Rathbun.

But with the internal combustion engine considered as the best means of motivation, and increased speed given by reduction of wing spread, other problems come up, such as holding landing speed to a safe figure, smaller freight space, and so on, which reduce the value of this greater speed—make it impossible until these other problems are also solved, and then each problem's solution must be blended into a compromise for the building of a whole that is more efficient than before

As suggested by an Italian, and partly being put into experiment by the Germans with their "rocket ships," the plane of "superaviation" days to come will be powered by an internal combustion engine, and by rocket principles. There will be no radical change in design, the essential difference being in the power plant.

As the physicists now see it, there will be no motor on the "nose." Instead, running lengthwise of the plane through its body will be a tunnel, narrowing to each open end. Air will be sucked in through the front entrance, compressed in the throat, heated here to a temperature of 600 degrees centigrade, forced from the throat after this heating into a center chamber, where its temperature will be raised to 1800 degrees centigrade. This is the expansion chamber.

The expanded heated air will be thrust out of the rear outlet of the tunnel, and the force of the exhaust will be of such power as to send the plane forward at some 1,000 miles an hour! Three hours to cross the Atlantic! Or from Los Angeles to New York, Savannah or Atlanta! The heating of the motivating air will be by a system of jets, and the chambers will (of course) be lined with heavy insulation.

That an airtight cabin for passengers is practical has been proven by the European construction of two planes which had such cabins. They would be equipped for super speeds and high elevations. For the craft, of course, would be a high altitude or rather a "stratosphere airplane," able to travel in and take advantage of the reduced air resistance miles above the earth. Present planes break records for speed by seeking the upper reaches of the air.

Landing of the prospective—or projected—airplane constitutes a problem. Will the air of itself serve as sufficient cushion to permit the plane to come to rest easily? Several methods of cutting down speed for landing are under consideration, but the present perplexing problem is how to get the ship under way. Of the methods suggested, three have found favor. The plane can be started on its journey by use of a catapult. It can be sent high into the air by use of rockets. Or it can be towed at the start by another plane.

Fantastic and improbable as a Jules Verne story, we may consider all this. But when these scientists, these physicists, get to smashing the infinitismal atoms in order to make a new metal that was needed but never existed before—well, we can smile quietly to ourselves—and watch developments, for speedier planes, of some type, (perhaps high atmosphere, then "stratosphere"), will be on their way.

Those who have suggested the stratospheric travel lanes, however, have neglected to consider difficulties that are almost certain to exist with meteorites and cosmic dust that abound at these high altitudes. To travel at the rate of 1,000 miles per hour through showers of rocks and meteorites of various types does not sound tempting.

At the lower atmospheric levels such impediments do not exist, because they are burned out by air friction before the dust and stones arrive at present transportation levels. Further, will come the difficulty of burning fuel at altitudes where the oxygen is so rare. It will be necessary to carry sufficient oxygen, in some form, with the ship.

What Our Readers Are Building

A department devoted to our readers' activities in airplane, glider and engine construction, showing the latest developments.

Use Of Veneer

SOONER or later, every home-builder gets the veneer fever and then, after his first trial, he suddenly changes his mind about this material unless he has handled it carefully.

Now, untreated plain veneer has a bad habit of coming and going with the weather if the surface is left open so that the moisture can enter the pores of the wood. However, if the pores are completely closed and protected by two or three coats of spar varnish, most of this difficulty will be overcome.

Untreated veneer, used as a wing covering, will ruffle up like a washboard in damp weather if not properly treated. However, if given the proper attention it is excellent material for many parts of the ship.

Necessity For Strong Ribs

RIBS carry a comparatively heavy load in transmitting the air load to the wing beams, and therefore should not be slighted. It is not sufficient to have them strong enough so that they will not break in flight but they should also be rigid so that they will not flex out of shape and spoil the contour of the wing.

Deflected ribs have spoiled the performance of many a plane and in the end they will destroy the fabric unless they are stiff enough and rigid enough to stay in shape. Everybody tries to cheat on the ribs, when they are after a weight reduction, but this does not pay.

About Those Tail Surfaces

MOST amateurs have a secret ambition to make a short chubby plane because "it looks cute," but this is bad practice unless an inherently stable main wing section is used—such as the M-6. They love to pull the tail right up to the trailing edge of the wing, and then they live to regret their act if certain unstable sections are employed.

Now, in the Chicago races, was a diminutive racing plane, a real baby racer that gave a good account of itself. There was not much more than a foot or so between the tail surface and main wing, but its success was due entirely to a large tail surface area and the fact that a highly stable form of wing was used. If there had been much travel of the center of pressure, even the little movement given by a Clark "Y" section, the instability would have been very pronounced.

In order to gain effective control, the tail group must provide enough leverage to overcome the couple due to the C. G. and C. P. This is most easily accomplished by providing a long lever arm—a long body.

Here's A Dandy Low-Wing Monoplane

This ship, was built by W. J. Sheehan, is the first low-wing monoplane that has been entered in these columns for a long time. Nice job, W. J. S.

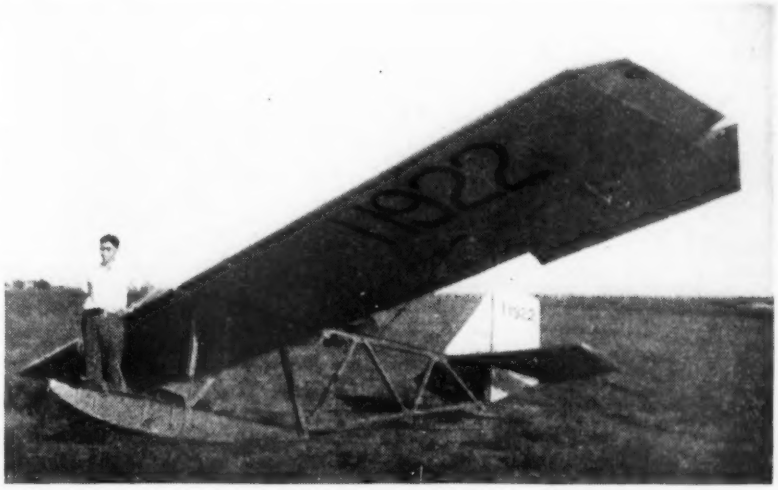
IN reply to our call for help, W. J. Sheehan very kindly responded with that alacrity for which most P. A. readers are noted. Mr. Sheehan, who hails from 89 Summer St., South Walpole, Mass., sent in shots of his low-wing mono which he built, and if cameras don't lie, she's a beaut. She flies very nicely, and was test hopped by Fred Chapman of the Westwood, Mass., airport. Mr. Sheehan wants the gang to write to him.

And They Call It the "Dodo Bird"

MARVIN J. GORDON and Frank Andrews, 3328 Classen Blvd., Oklahoma City, Okla., have built two gliders, the last and most successful being the "Dodo Bird" that was built from plans published in P. A. In short, it is the Rhon Ranger with certain structural reinforcements added.

It took about 10 months and cost about $80, for they used aircraft material throughout, plywood leading edge, push-rod controls and other improvements that finally resulted in an overweight of about 100 pounds.

However, the overweight did not interfere with its performance for it outflew a commercial model and finally got it up to 500 feet altitude with a steel wire. They are well satisfied with the results for it flies "hands-off."



Here we have the "Dodo Bird" in all of its glory. According to its builders it "flies hands off."

Dream Ships by Our Dreamers

Here we have an open forum for the ideas of our readers who have been bitten by the designing bug. All are interesting, some are good, some are fair and some are—

IN THE mad quest for the improvement of alleged aerodynamic efficiency, the amateur designers of lightplanes have more or less ignored the many excellent qualities of the triplane. This seems strange, in one sense, for compactness in a lightplane is as much a virtue as the conservation of a few gallons of gasoline. The dollars and cents saving effected in storage space by the triplane arrangement is an economy of the first order.

Consequently, we take pleasure in showing you, the light triplane designed by Mr. Loder which presents several points of interest. He has given it the name of "Tri-Roller" which in a way indicates its purpose, for Mr. Loder believes that it would shine brilliantly in the field of stunting and particularly in barrel-rolls and the like. Because of its short span, being a triplane, it could easily land in streets and other narrow places in case of necessity and would not be as greatly influenced in cross-wind landings for the same reason.

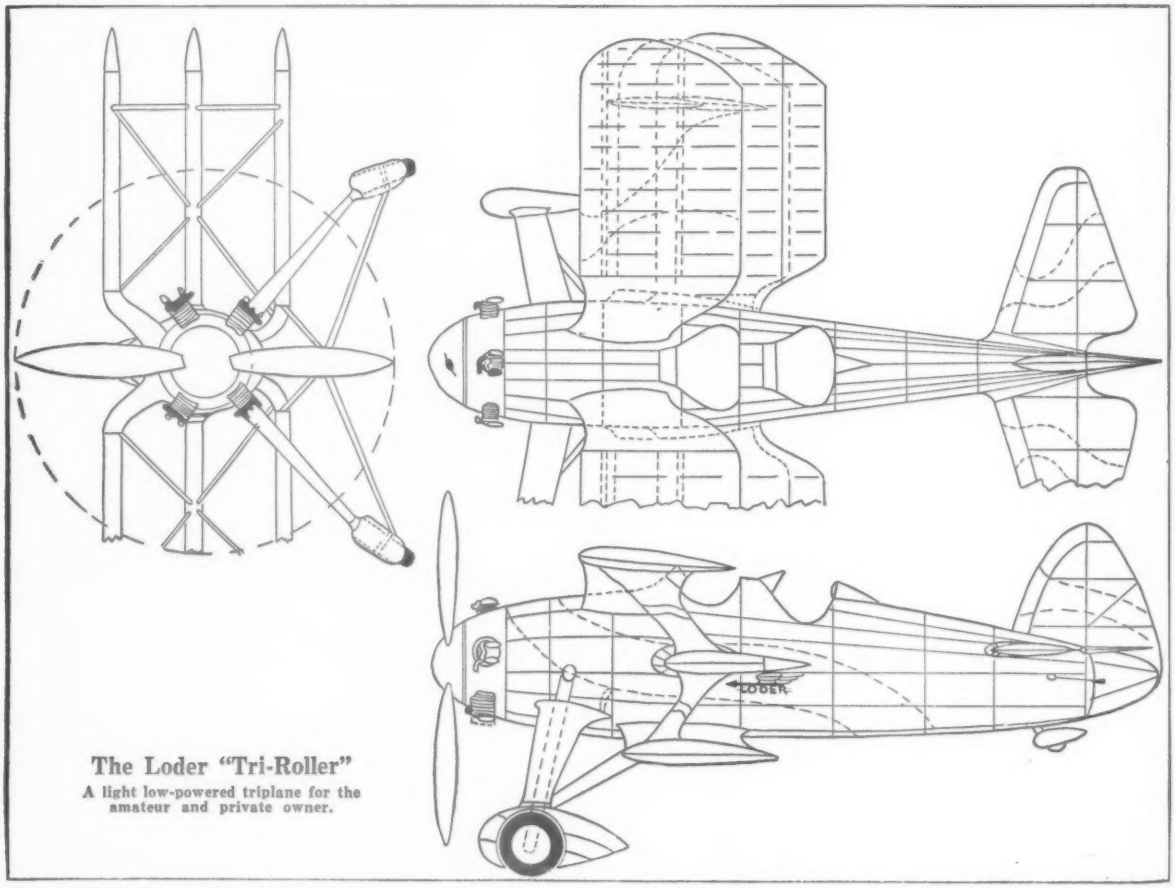
Provided with a Kinner engine of 100 h.p., the expected top speed is 150 m.p.h., while the estimated landing speed is 45 m.p.h. This does not sound unreasonable in view of the general nature of the design, which on the whole, seems very good.

The designer proposes the use of wire braced wings, which can be easily built with a plane of this type, using metal ribs on solid spruce spars. It will also be noted that a peculiar stagger is given to the three wings which may present certain advantages in the way of lift-drag ratio, although we have no definite data on the performance of such an arrangement. With a little study, it might even be possible to work out a simple and effective hinging arrangement whereby the wings could be folded back for further compactness in garage or basement storage.

Full cantilever type tail surfaces are to be provided, combined with either a welded steel or monocoque fuselage. This would seem to be an easy design for applying fillets and similar refinements to increase the aerodynamic efficiency of the ship as a whole and which would to a very considerable degree, offset the losses that might be due to the triplane wing grouping.

There is one thing to bear in mind when a triplane is under consideration, and that is the fact that triplane groups are not so very inefficient at small angles of attack. Therefore, to use a triplane for speed work is not so very far out of line. It is only at high angles of attack that the L/D ratio falls off to any extent, and in view of the other advantages of the triplane, this should not militate against the triplane principle for pleasure planes. In normal flying at thin angles, the power consumption would not be so far from that experienced with a biplane.

In view of the short span, light loading and comparatively wide chord used with this machine, it would seem that full cantilever wings could easily be arranged, thus avoiding the nuisance of wire and strut bracing. This arrangement would also permit of a simple hinging arrangement whereby the wings could be folded back for storing in narrow quarters.



The Loder "Tri-Roller"
A light low-powered triplane for the amateur and private owner.

Building the P.A.Contest Model

by JOSEPH S. OTT

PART I

In this article, Mr. Ott begins the series of instructional articles and helpful hints on the model to be built for the contest. Read the rules and regulations for entering the contest on page 226.

ALL model builders are invited to enter the International Contest sponsored by POPULAR AVIATION in conjuction with the Boeing Airplane Company and the United Air Lines. For full details of the prizes, see special notations in the Model Department. The drawings appearing with this article were reproduced from the original Boeing factory blueprints.

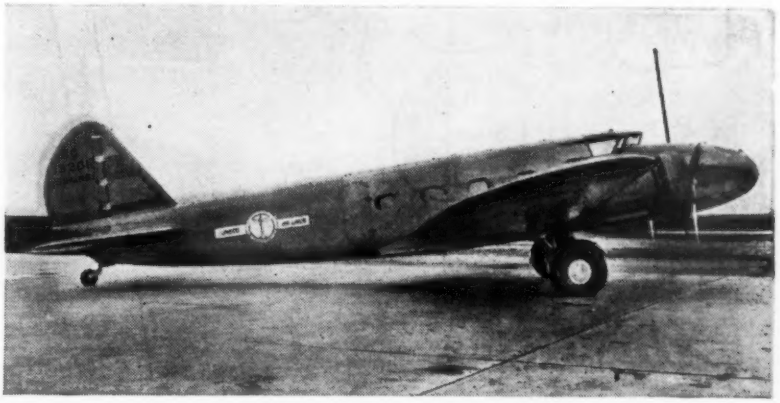
The drawing is to a scale of ⅛ inch to 1 foot or 1/96 of full size. Dimensions given are full size for the big airplane. The prize winning model may be any size. Photographs of all models competing must be mailed in to the model Department of POPULAR AVIATION and from these photographs the best appearing models will be chosen and the builders will then be requested to mail their models in for final examination and awarding of prizes.

Model builders should bear in mind that this contest will be won by the model builder who will be able to duplicate in detail as many features in miniature as is possible. For this reason, photographs of the large machine will be shown in the Model Department so that the builders in the contest will have all the information available regarding the full size details.

If the model builder decides to construct his model ¼ inch to 1 foot, the wing span will be exactly 18½ inches overall. Note that no details of the inside of the fuselage are given on the drawing proper. The outline of the plane, with the cross-sections of the body, the wing, the stabilizer and the rudder are illustrated. A model constructed to the size mentioned above is large enough and will easily contain sufficient details.

The next size would equal 3 times the illustrated scale and the wing span would then be 27¾ inch overall. Scaling a model along this ratio—⅛th, ¼th, ⅜ths and ½ of an inch to 1 foot—does not prevent the model builder from using smaller fractions such as ⅛ inch to 1 foot which would make the overall wing span of 23⅛th of an inch. This makes the model almost 2 feet across and should make the ideal size. However, the contestant must use his own judgment in selecting the size, but the parts must be of a corresponding ratio.

It is suggested that the body be built up with longerons, formers and stringers. The body, wings and tail may be covered with thin balsa and painted aluminum. There are no specific rules requiring any certain material from which the model must be built, either raw materials or commercial kits may be used. Some model builders will be able to build very neat models entirely from balsa—others will build from metal.



This is a side elevation of the Boeing "247" low-wing twin-motored monoplane from which the contest models are to be reproduced.

After the model builder has selected the size to which he would like to build, he should make his own drawing, change the general overall dimensions as required and then start working in the details to the best of his ability.

CONSTRUCTING THE WING

Assuming that the model builder has decided to start with the wing first, he should refer to the photographs illustrating this part as constructed for the full size machine. On his drawing, an equal number of ribs should be shown. The general construction method employed for assembly of the rib should be used and followed on the model very closely resembling the large rib.

The location of the spars should be checked on the photographs and should be transferred to the drawing in the process. It may be advisable to build the wing in three sections—the left section, the right section and the center section. To insure accuracy the complete wing should be assembled as one piece and then cut in 3 units so that the center section may be set into the body and so the wings extending beyond the center section can be removed at will for examination of the internal construction which may prove an advantage in deciding detail.

CONSTRUCTING THE AILERONS

The ailerons are long and narrow and by all means should be movable even though they are not connected

(*Continued on page* 258)

A large scale drawing of the Boeing "247" suitable for tracing (scale ⅛" to the foot thus reducing the model span to 23 inches approximately). Simply fill out the coupon below and mail it to the address given.

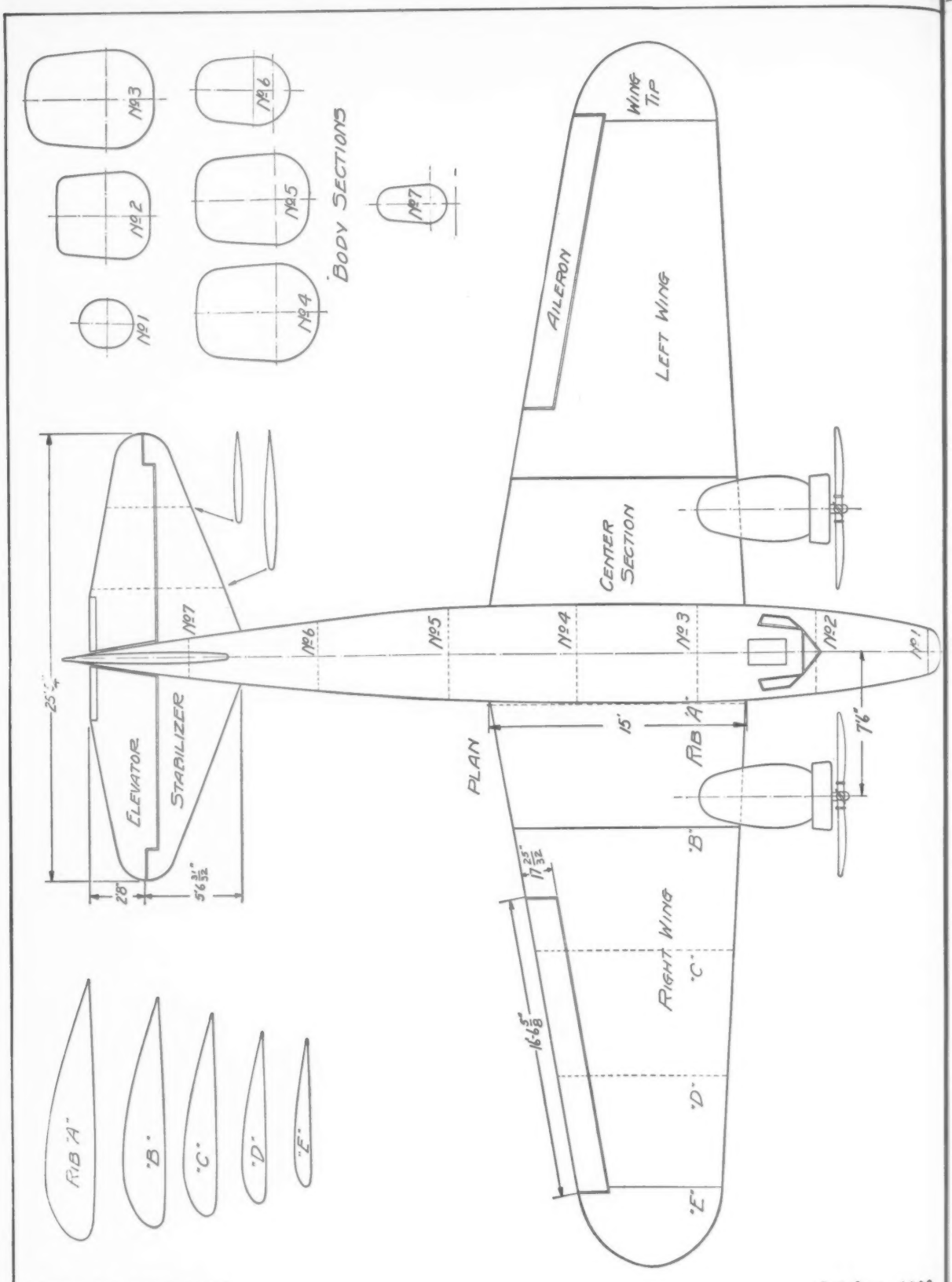
POPULAR AVIATION, Box 200, 4-33
608 S. Dearborn St.,
Chicago, Ill.

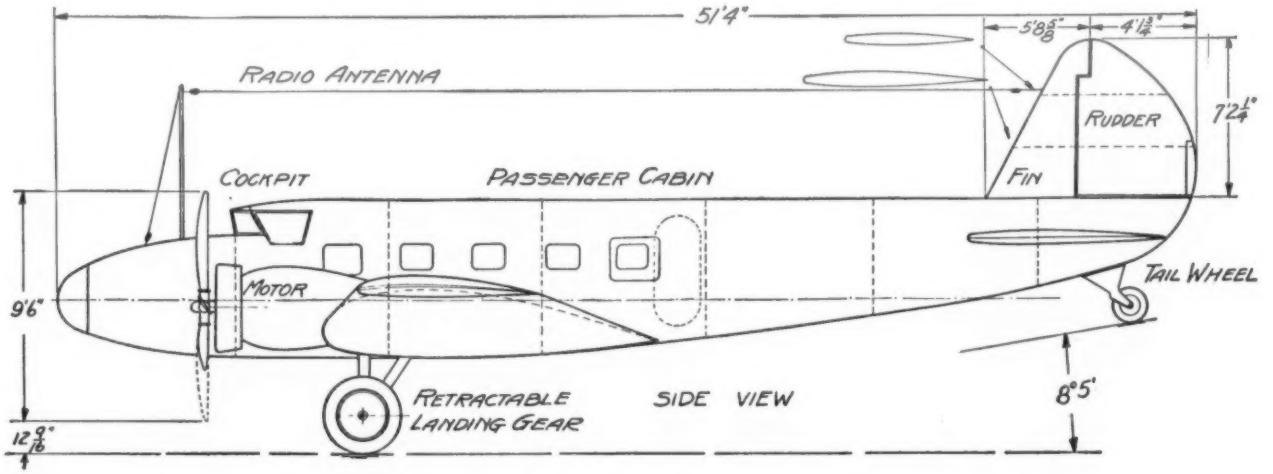
Please send me the large scale plans of the Boeing "247" monoplane.

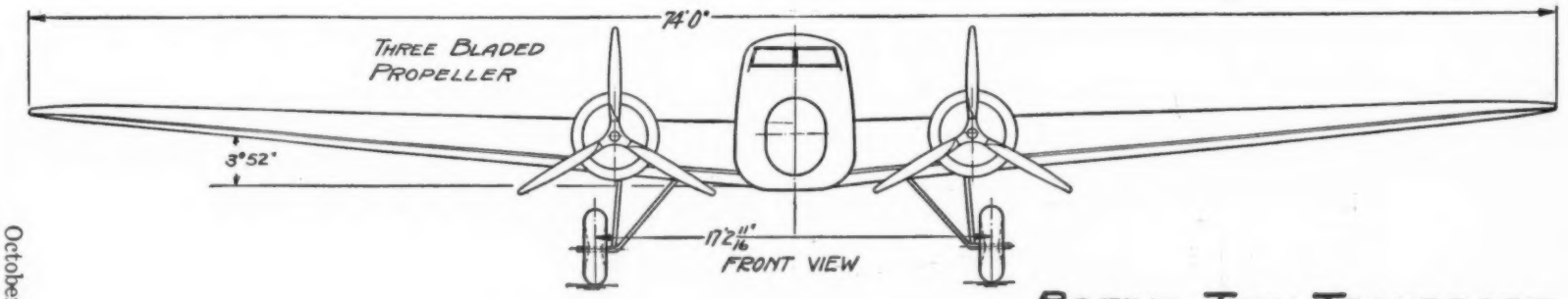
Name .....

Address .....

City..... State.....


BODY SECTIONS
№1
№2
№3
№4
№5
№6
№7
WING TIP
AILERON
LEFT WING
CENTER SECTION
ELEVATOR
STABILIZER
25'-4"
2'8"
5'6 31/32"
PLAN
15'
RIB 'A'
7'6"
'B'
11 25/32"
16'-5 16/16"
RIGHT WING
'C'
'D'
'E'
RIB 'A'
'B'
'C'
'D'
'E'





BOEING TWIN TRANSPORT

Boeing "247" Model

(*Continued from page 255*)

with the control in front of the pilot's seat. Special attention should be paid to the method by which the wing streamlines over the ailerons.

CONSTRUCTING THE LANDING GEAR

The landing gear is retractable and after the plane has left the ground, the landing gear struts and the wheels disappear almost completely into the wing. The construction of a retractable landing gear is not very difficult. The two front uprights are hinged and held in place by the rear strut when the landing gear is in the fully extended position.

CONSTRUCTING THE BODY

The greatest part of the credit in judging the models will no doubt be centered on the body. There is no one method specified in which the body must be built.

A few large, strong members running longitudinally from the nose to the tail of the ship around which the form and shape of the body is constructed, should be used as a foundation. The position of these longerons should be so arranged that they are either above or below the windows and do not run through the center of them.

It may be advisable to make a part of the fuselage from the front of the pilot's cockpit to the rear of the door deep enough to include the windows and on both sides removable. A very neat fit should be made of this part and a big advantage can be gained, thereby, permitting the construction of the seat and the interior of the cabin in more detail.

The nose of the body is hinged and opens to permit the placement of baggage and mail. The large machine has a smooth skin metal covering. The covering may be accomplished by the use of heavy tissue, thin balsa or thin aluminum. If tissue paper is employed it should be given one or two coats of light dope which will stretch the covering very taut and then colored in aluminum.

Full details for coloring will be given later. If the covering is made from thin balsa it should be put on in small sections, sanded down at the rough corners, given two coats of dope, possibly 3 or 4 if necessary, and then finished off in aluminum. All trimming is done in black.

It is advisable to use thin strips of black tissue paper cementing them in place with banana liquid. A neater job can be made than with a brush and black paint. However, if one is extremely handy with a brush, it is advisable to use high, glossy lacquer. For colored trimmings and color schemes, see paragraph on general specifications.

(*Concluded on page 269*)

Build This Replica of the Savoia-Marchetti

by JACK KNOBLE

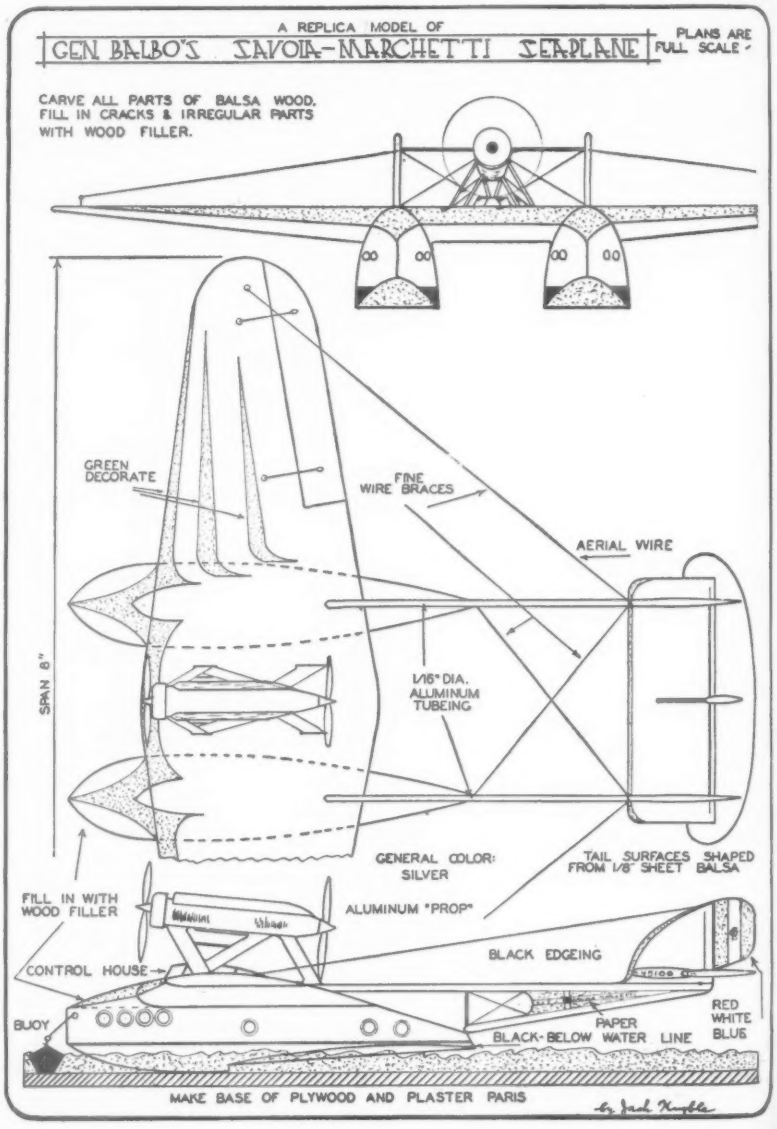
HERE is a simply made, yet effective, replica of a Savoia-Marchetti boat flown in the squadrons brought across the Atlantic by Gen. Balbo. It is a memorial of this great adventure by the Italian Air Forces which would be appropriate for your den or living room.

There is not much to be said about this construction except that the two hulls and the wing are made separately from balsa wood and are afterwards cemented together as shown. Since this is a small scale ornament, great care should be taken to have a carefully finished job, finished dead smooth with several coats of lacquer, sanding down between the coats.

It adds much to the realism of this model to make the ailerons separately and then hinge them to the wings. However, they can be indicated by a thin black line drawn on the upper and lower surfaces of the wing as shown in the drawing. The elevator, however, should be separate from the fixed stabilizer.

Some prefer to mount their replicas on small wood pedstals, but I have shown a mounting that adds realism to the assembly. A thin baseboard is made and then is covered with plaster of paris, the surface of the plaster being rippled to represent waves. The hull is then pressed down into the plaster so that it looks as if it were floating.

After the plaster has dried for several days, it can be painted sea-green.



What the Industry is Doing

Latest bulletins from the airplane, engine, equipment manufacturers and dealers boiled down into a nutshell. Contributions to this department are invited.

SMITH CONTROLLABLE PITCH PROPELLERS have established two notable records, the round-the-world record by Wiley Post and the land-plane speed record set up by Jimmy Doolittle with his Gee-Bee. According to a telegram sent to The Smith Engineering Company, Cleveland, Ohio, by Wiley Post, this controllable pitch propeller was of great service in making quick take-offs from emergency fields with heavy loads.

SALES REPORTED for the Kinner low-wing monoplanes are considerably ahead of production, according to The Kinner Airplane and Motor Corporation. This company now has 50 contracts for the monoplane and the number of employees has been doubled within the past two months. The Company has just completed shipment of a substantial order of engines for the Mexican Government through the Consolidated Aircraft Corporation.

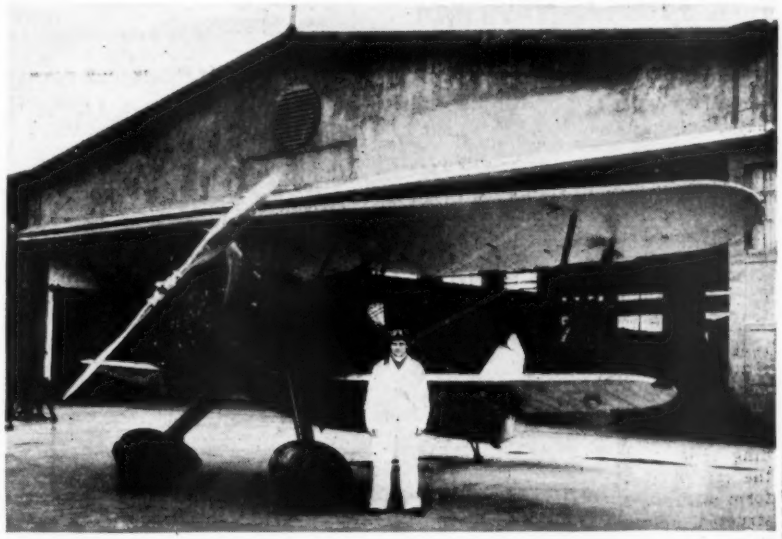
PAGE-ALLEGHANY ALLOYS in round, flat and shaped wire forms will be fabricated by the American Chain Company and associated companies in the future. This new wire will be marketed under the name of Page-Alleghany Alloys and will be sold by the Page Steel and Wire Company, Manessen, Pennsylvania.

WESTINGHOUSE ceiling projectors are used to determine the height of the clouds above the airport. An order for 25 of these projectors has recently been received from the Federal Government, through the Weather Bureau, by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. The light beam of the projectors, rated at 650,000 candlepower, is directed upward upon a cloud. An observer at the station then focuses a height finding instrument upon the spot of light, afterwards calculating the height by trigonometric methods.

AN AIRPLANE TAIL-WHEEL of a new and practical type has successfully passed the Department of Commerce engineering and flight tests. This tail wheel is manufactured by the Air Transport Equipment Company, Roosevelt Field, Mineola, N. Y.

THE CHINESE GOVERNMENT has ordered 36 Cyclone powered Curtiss Hawk single-seat fighters from the Curtiss Aeroplane and Motor Company, Buffalo, N. Y. These are among the fastest pursuit planes in the world, having a top speed of over 200 m.p.h. and are capable of diving at a speed of 350 m.p.h. The first of these ships was demonstrated before 75,000 Chinese at Shanghai, by Major James H. Doolittle.

NORTH AMERICAN AVIATION, INC., announces the consolidation of the B/J Aircraft Corporation with the General Aviation Manufacturing Corporation, whereby the B/J becomes an integral part of the latter company. The General Aviation Manufacturing Corporation, the successor of the old Fokker Aircraft Corporation, was acquired as a wholly owned subsidiary of North American Aviation by a recent exchange of North American Aviation stock for certain assets of General Aviation Corporation.



One of the Curtiss Hawks supplied to the Chinese government by the Curtiss Aeroplane and Motor Co., Buffalo, N. Y. Jimmie Doolittle, who demonstrated the ship is shown standing beside it.

B/J Aircraft Corporation, a subsidiary of North American Aviation since 1930, has concentrated on the development of military planes. Mr. Temple N. Joyce, one of the organizers of the Berliner-Joyce Aircraft Corporation, the predecessor of the B/J Aircraft corporation, will become Executive Vice-President and General Manager, while J. M. Schoonmaker remains president of General Aviation.

UNITED AIRLINES reported a new performance record for high-speed multi-motored passenger planes to the Post Office Department, when it flew 99.98 percent of the 513,827 miles scheduled on its Chicago-California and Chicago-Seattle routes. All but 139 miles, out of more than a half million miles, were completed during the 30 day period.

PARKS AIR COLLEGE, East St. Louis, Ill., states that 12 leading air-transport and airplane manufacturing companies now employ Parks graduates. Other Parks Graduates are employed by 73 smaller aircraft companies, while more than 265 graduates are in business for themselves.

THE CONTINENTAL MOTOR COMPANY, Detroit, Mich., have appointed Engine Service, Roosevelt Field, Mineola, N. Y., as district representatives and authorized headquarters for service in that area.

THE AIRSTER is a new lightplane about to be placed in production by the Security National Aircraft Corporation, Downey, Cal. This ship is a two-place low-wing monoplane powered with a 5-cylinder Kinner engine and is constructed so that when the wings are folded back, the width is only nine feet. W. B. Kinner, the president of the corporation, expects to have the factory under full operation within a short time.

MIDGET RADIO RECEIVERS, for the convenience of pilots operating planes equipped with W. E. radio telephone systems, are now being produced by the Western Electric Company.

EXPORT ORDERS amounting to $2,500,000 have been received since January 1, by the Curtiss-Wright Corporation. This total is equal to the entire export business during 1932. The orders include 101 airplanes, chiefly of the military type and engines.

TO ENCOURAGE YOUNG MEN in learning more about airplanes, the Stinson Aircraft Corporation, Wayne, Mich., and the Stinson Air Cab Operators' Association, are sponsoring a model contest during the month of September. They are offering $500.00 in prizes to the young men of the United States and Canada who submit the best scale non-flying models of the 1933 Stinson "Reliant," a four passenger cabin plane.

THREE BOEING GRADUATES have been given positions as airline co-pilots by the United Airlines, while three other graduates have received promotions to higher positions with these lines. Joe Eberly has been advanced to first pilot on the Seattle-Portland run, succeeding Alan Smith, another graduate, who has been assigned the job of ferrying the new 217 Boeing transports from the Boeing factory to various points along the line. Master mechanic graduates have been distributed to the Chicago terminal and other points.

SUNNYVALE IS TO BE FLOOD-LIGHTED by 24 explosion-proof lights now on order from the Westinghouse Electric and Manufac-

turing Company. The Sunnyvale dock will eventually house the U. S. S. Macon. The new floodlight is totally enclosed within a special refracting lens which prevents any danger of exploding a hydrogen-air mixture.

AIR-EXPRESS business, over the 12,500 mile air-transport system of the Railway Express Agency, Inc., increased by 204 percent in shipment units during June over the shipments at a corresponding period last year. This increase, though not of the same magnitude, has been consistent during the preceding months of 1933.

300,000 GALLONS is a lot of lubricating oil, but this is the amount contracted for by the United Air Lines with the Pennzoil Company. The engines of the new Boeing "217" low-wing transport consume 60 gallons of gasoline and six quarts of lubricating oil per hour, therefore a 24 hour coast-to-coast flight calls for 1,200 gallons of gasoline and 30 gallons of lubricating oil. The Standard Oil company supplies about 8,000,000 gallons of gasoline per year to the United Air Lines.

THE CURTISS-WRIGHT PERSONNEL, at the request of the Turkish Government, has surveyed 4,200 miles of proposed airways in Turkey. The first airline of the Turkish Government is now in operation between Ankara and Istanbul, using Curtiss-Wright "Kingbird" transports, flown by American pilots. Under the supervision of American personnel, the Turks are now building Curtiss Hawks and Fledglings in their own plant at Eskisehir.

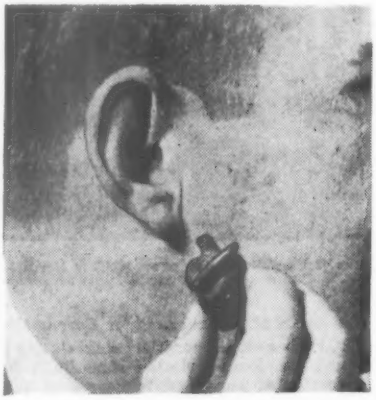
STINSON PLANE NEWS, is a new publication by the Stinson Aircraft Corporation which presents interesting facts concerning Stinson planes and Lycoming engines. The first issue, just off the press, features the Stinson Reliant and also discusses the Model U, tri-motor transport plane. Excellent photographs and line drawings illustrate the text.

A NEW FLOODLIGHT, known as the Type 36,-000 GRL, has recently been added to the line of the Pyle-National Co., Chicago, Ill. It uses the 115 volt, 5,000 watt, type G-64 airport lamp which provides about 8,400,-000 beam candlepower. It has been specially developed for what is known as the "end of runway" lighting for airports.

THE FAIRCHILD "22'", a Gypsy powered parasol type monoplane, is now being produced by the Kreider-Reisner Aircraft Co., Inc., Hagerstown, Md., a subsidiary of the Fairchild Aviation Corporation. Provided with the Wright Gypsy engine, this O. C. job does 110 m.p.h. and climbs 600 feet per minute.

NICKEL ALLOY CHARTS, which show the properties of various nickel steel alloys at a glance, have been issued by the International Nickel Co., Inc. The figures, which are based upon reliable test data, give the various nickel-steel compositions and heat treatments required for developing yield points up to 175,000 pounds per square inch in different sizes of sections. The charts are valuable to engineering departments and heat-treating plants where alloy steels are of importance.

JOHN ARMSTRONG, Oak Park, Ill., and Rosmond Blauvelt, New York City, both graduated from the Ryan School of Aeronautics, San Diego, Cal., in April 1933. Today, Armstrong is president of the A. T. C. Aeronautical School, Inc., of Chicago, Ill., while Blauvelt is operating a field of his own near New York and is the Great Lakes dealer in that territory.



The new Western Electric midget earphone.

SCHEDULED AIRLINES, operating in the United States, carried a total of 38,543 passengers in May, 1933. This indicated an increase of about 9,000 over any month of this year. 12,629,025 passenger-miles, or a total of 4,079,091 airway miles, were covered during this period.

ON JULY 1, 1933, there were a total of 2,-136 airports and landing fields in the United States, an increase of 99 fields since July 1, 1932. The total number is built up of 550 municipal, 653 commercial, 269 Department of Commerce intermediate landing fields, 525 auxiliary fields, 55 Army fields and 16 Navy fields.

The Winds at High Altitudes

THE meteorological section of the 18th Composite Wing, recently made some observations of the winds at very high altitudes.

These observations consisted of pilot balloon soundings made at various times with special balloons that ascend 200 yards a minute. The highest altitude attained at this station was 42,300 feet, which the pilot balloon reached in 70 minutes.

This observation showed the usual moderate northeasterly winds for altitudes up to 9,000 feet. Above that altitude, the direction of the wind gradually became southeast, south, and then southwesterly to westerly. The velocity remained moderate, around 20 miles per hour, up to an altitude of 33,000 feet, when it increased to a maximum of 50 miles per hour at 39,300 feet. From this point the velocity of the wind rapidly fell off to 14 miles per hour at 42,300 feet.

The fact that the wind velocity fell off at the highest altitude is unusual, because the velocities at such altitudes usually remain quite high, averaging 55 miles per hour in the summer time and 70 miles per hour in the winter. The westerly direction shown at upper altitudes is the prevailing direction of the upper winds aloft for the northern hemisphere.

The temperature at the altitude reached by the balloon in this observation was approximately 70 degrees Fahrenheit below zero, and the barometric pressure was around six inches of mercury, as contrasted with a temperature of 82 degrees Fahrenheit and a pressure of 30 inches of mercury at the surface.

Another upper air observation was made the next day. In this observation, the wind remained easterly with moderate to gentle velocities up to an altitude of 11,000 feet. From this point, the wind direction became successively southeast, south and southwest at 24,-000 feet, when it remained west-southwesterly for the altitudes from 24,000 feet to 33,000 feet.

The velocity from 11,000 feet gradually increased to 59 miles per hour at 30,900 feet.

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DETROIT, MICHIGAN WALKERVILLE, ONTARIO

Airy Chat

(Continued from page 218)

one" on us, whether he was simply possessed of insufficient and incorrect facts regarding the matter, or whether he was simply showing Mr. Story a good time, will never be known, but anyway here is a rebuttal by Mr. Nelson Story III who makes certain corrections and additions to the short story printed in the August issue of P. A.

While perusing the table of contents for the August issue of POPULAR AVIATION, my attention was directed to an article entitled, "Lightplane Carries Gold From Mines." Being in the mining game, I was naturally interested.

One glance at the picture and I knew that something was up. I hurriedly read the article and enjoyed a good laugh. Later and in private, I reread it quite seriously, mentally digesting every word. My heart glowed, my head swelled and carefully taking stock of myself, I arrived at the conclusion that I certainly must be good—for it says so in black and white in the columns of one of the most widely read magazine in flying circles—POPULAR AVIATION. Whataman!

Aside from a few little inaccuracies, which I will enumerate, the story was approximately correct and I might add, beautifully written. The first error, though not serious, is that I have never carried any gold to the assay office. The reason, for your information, is that the insurance rates on gold transported by plane are extremely high. In fact, the only people that will insure gold shipments by plane are the Lloyds of London. I do, however, visit the dredge by plane.

The little mine way up in the mountains is a mere trifle. It is only a floating dredge weighing around 450 tons. Frankly, we experienced some difficulty in transporting the outfit up there in saddle bags, so I carried the bucket line and tumblers to the diggings in my trusty flying machine.

The field at the mine is not so hot. It is 6,200 feet up, one way, and the wind always blows cross-wise or in the wrong direction. If I don't quit flying over there, the next time my name is mentioned in your magazine, it will be in the obituary column.

I do fly around in the winter, although not unmindful of the weather. I remember, about four years ago, when the Arctic Patrol came through Montana, I was unduly curious to ascertain why they were having such a tough time of it. The thermometer stood at 30 below. I warmed up my engine and stood by waiting. Finally a few came over and I lit out after them.

High frosty clouds obscured the continental divide and I had to fly at 10,000 feet to get over. Naturally, while out of sight of land, I indulged in considerable rubbering over the side and during the process my mask was blown off. Immediately, I was frightfully cold, however, in just a few moments I was quite comfortable again, the air was smooth and the "sun dogs" at that high altitude were beautiful. I was enjoying the experience hugely and considering the army pilots a lot of sissies.

I came down through the frosty mist into Butte and landed. It was so cold that the shock-cord on the plane that I was flying at that time snapped like so many wooden sticks for the rubber was actually brittle. The shivering attendants at the airport rushed me to a hospital where I remained for almost a month with a badly frozen countenance.

All in the spirit of fun, I would certainly like to know where you got all the dope concerning my flying activities. The only picture of my plane that I know of, hangs in the office of the Story Gold Dredging Company and I hope that

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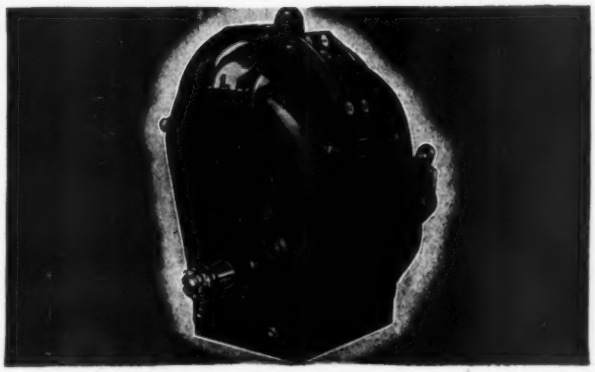

I am not given to passing out colorful interviews even when in my cups.

I have not missed a copy of your splendid magazine in years. I do not subscribe as a news stand occupies one of our buildings and they always save me my copy.

By the unfailing bond, I am yours,
Nelson Story III
Transport 12374

A mighty fine letter, I'm telling you. It is just another case where one good story begets another. I would be glad to pass on the name of the author of the story, but alas, the author's name is not recorded in our office.

H. BAILEY WILSTON, Huntsville, Muskoka, Ontario, an old friend of P. A., sends us the following interesting letter from Canada. His concluding paragraph proves, however, that he has kept in contact with the Airy Chat for he has a substitute, and a good one, for that "happy landing" line.

It is sometime since you have published any news from Canada in the old Airy Chat, so here's to revive memories a little.

I have sometimes wondered what became of crates that have seen years of hard service, but here's what happens up in this wild and watery district. I have just discovered that a perfectly nice Gypsy Moth seaplane decided sometime ago to rest on the oozy bed of one of Canada's inland oceans.

She went in with a red hot engine, forty miles from the nearest railroad. I believe she is under 250 feet of water and some day, somebody looking for derelict vessels, will find a different kind of a derelict.

Did you say, "What about the peelot?" They didn't say anything about him except that he liked swimming under water.

I just had a look at a lovely Buhl Airsedan on floats, cruising around these Muskoka lakes. You can have your city airboats but I like the smell of gas mixed with the watery savor of a northern inland lake. And these hills. Irrisistible!

Congratulations on unceasing efforts to make a bigger and better P. A.!

Yours, until I run out of gas,
H. Bailey Wilston.

It seems good to hear from northern Canada, this letter seems to carry the aroma of the pines—and frying fish—right along with it. Let's hear from you again, H. B. W.

* * *

IN THE last issue we started another department which we believe will be of great interest and on which we have received many favorable comments. This department, "What the Industry is Doing," keeps our readers in touch with the activities of the manufacturers, dealers and the airway news of the United States. But—to keep it active requires that we receive contributions from those engaged in the industry and the airports. So send in any news that you think would fit in with this column.

* * *

PAGING Mr. McGregor! We have had several inquiries as to your present status from the customers of the Airy Chat and, for our own peace of mind, we wish to locate your niding place. Please come hither, Mr. McGregor, we are anxiously awaiting a letter from you.

* * *

AEROBATICS a la Cow Pasture, which appeared in the September issue, was written by Robert H. Collier of Tennessee. *An Aeronautic Laboratory for only* $10.00, in this same issue, was authored by Mortimer Rosenbaum of New Jersey.

* * *

WE HAVE just received a suggestion from one of our readers to the effect that the front page should be put into the middle of the book. This would better preserve the cover illustration, according to his views and would do away with the necessity of any printing on the cover illustration. O. K., my dear sir, but you have omitted to tell us what to do after we put the back cover in front.

Well, so long for this time.

J. B. R.

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WE MUST reduce our overstocked bookshelves. Some of these standard books will be sold at bargain prices — far below list price. You should take advantage of this opportunity at once for we will not replenish this stock. Send in your order now — do not delay.

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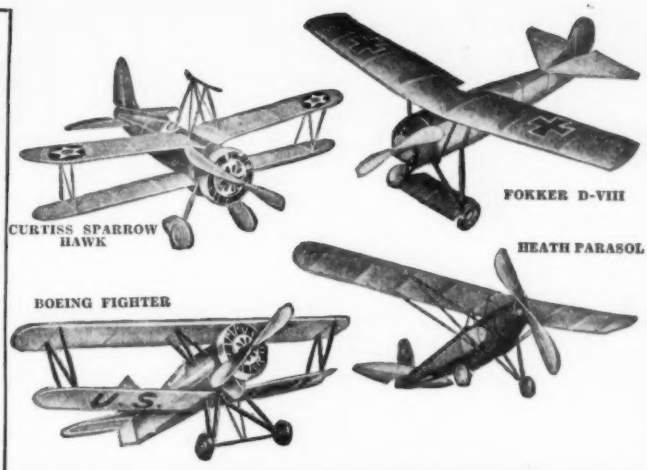

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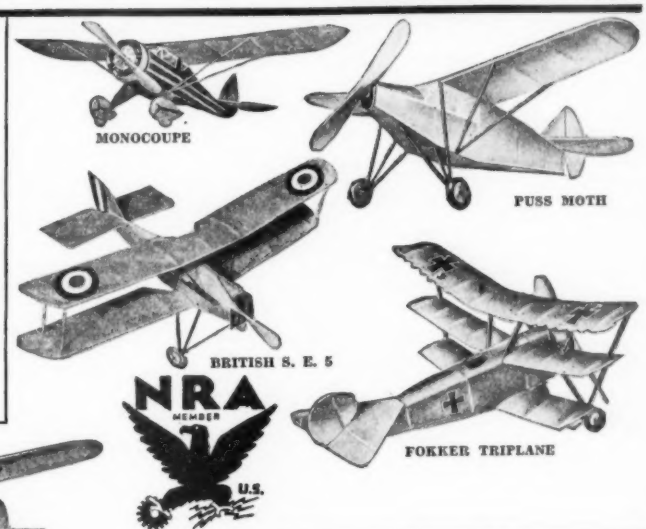

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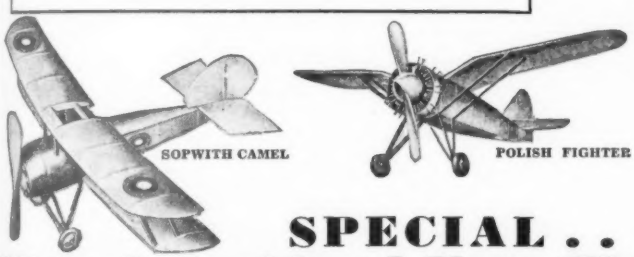

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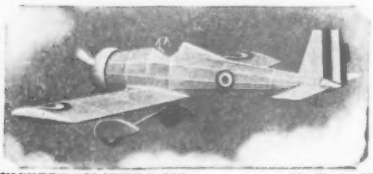

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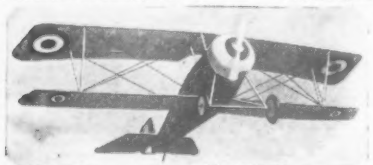

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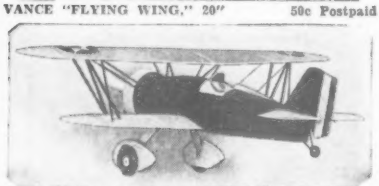
BELLANCA "PACEMAKER," 20" 50c Postpaid

VANCE "FLYING WING," 20" 50c Postpaid



CURTISS "GOSHAWK," 20" 50c Postpaid

FAIRCHILD "22," 20" 50c Postpaid

See our Exhibit at Chicago World's Fair Air Show

Scientific Model Airplane Co.

277P HALSEY ST., NEWARK, N. J.

Wasp Engines

(*Continued from page* 244)

the cams and tappets are still exposed to view.

The cylinders are of composite construction, the barrel portion being machined from steel forgings and have finely-spaced cooling fins. The cylinder heads are made of aluminum-alloy castings, screwed and shrunk on the barrels in the conventional manner. The rocker boxes are cast integral with the heads. Great care has been taken to literally wash all the heated portions of the head with cooling air.

Much finer finning than that usually employed is used both on the head and barrel, thus providing for the maximum amount of radiating surface. The exhaust valves are of the internally-cooled type while the valve seats are of aluminum-bronze forgings shrunk into the heads. The entire valve gearing being completely enclosed, provision is made by internally-drilled passages for easy lubrication of both ends of the push rods and rocker arms, as well as the rocker bearings.

As mentioned above, the entire power section may be assembled and the valves timed and set without special reference to the nose and rear sections of the engines. This feature makes for rapid assembly in time of necessity, inasmuch as the three major sections may be built up independently of each other and then the whole assembly completed.

The rear section is comprised of two major castings, one being what is commonly known as the "blower section," providing the blower ring and 14 separate outlets to which the cylinders are connected. The other is the rearmost casting, forming the supercharger diffuser section and carbureter inlet elbow, as well as the support for all accessories. On this latter casting are mounted an Eclipse starter, a Stromberg double-barrel carbureter, two 14-cylinder Scintilla magnetos, oil pumps, oil strainer, fuel pump, two-gun-synchronizer drives, two tachometer drives and the generator drive.

The rear-section assembly is similar in design to the rear end used on the single-row Pratt & Whitney models and has built into it a General Electric centrifugal-type supercharger. A clutch of generous size is provided in the supercharger drive train for the purpose of reducing the stress on these gears. Special study has been given to the development of the carbureter elbow and entrance to the supercharger impeller to provide for uniform distribution of air and liquid entering the impeller. Because of this feature the engines idle and run smoothly over their entire range of operating speed.

The nose section of the crankcase encloses a "spur-planetary" type of propeller reduction gear so designed that all teeth may be ground. A bell gear is attached to the forward end of the crankshaft by means of splines. The hub of this gear is supported by a roller bearing carried in an aluminum diaphragm mounted on the front section of the crankcase. Six planetary pinions mesh both with the bell gear and with a fixed or sun gear carried in the nose section of the crankcase.

The propeller-shaft is a nickel-steel forging carried on two bearings spaced a considerable distance apart. The forward bearing, located just behind the propeller hub and carried in the nose section, is of the anti-friction type.

END.

"I attribute my success to the high class training received at Lincoln"

Morris Cooper, another Lincoln graduate who found that Lincoln's high class training meant success.

LINCOLN Graduates Get the Best Jobs!

Further Proof that Lincoln Graduates are successful in Aviation.

Mr. Cooper's letter reads in full:

"On completing my Limited Commercial Course in your school, I immediately secured a position with the Council Bluffs, Iowa, Airways. Later I was fortunate in securing a position with the Chicago Tribune, delivering their newspapers to Minneapolis by air. I attribute my success to the high class training received in your school. I am firmly convinced that aviation holds a wonderful future to the young man who secures high class training such as he can get in your school." Morris Cooper.

This world's best known school is famous for turning out better trained pilots and mechanics. Our Government Licensed Instructors know how to train YOU for the big pay jobs in Aviation.

Come to LINCOLN and be sure of success. Government Approved School, internationally known. Unexcelled equipment. Training that leads to quick advancement including blind flying, cross country, acrobatics, master mechanics, airplane and engine course.

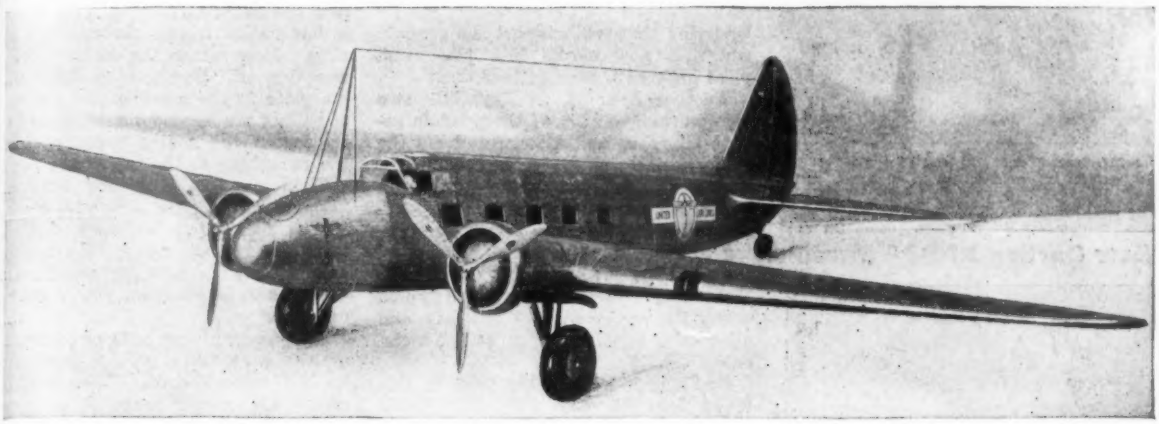
Big opportunities in both Central and South America as well as in U. S. Aviation courses taught in either English or Spanish. Act now!

WRITE today for all the facts. Now is the time to get started in aviation. State your age.

LINCOLN AIRPLANE & FLYING SCHOOL

238C Aircraft Bldg. Lincoln, Nebraska

Authentic C-D model of one of the world's most outstanding commercial airplane BOEING 247



Here are two realistic views of the new ¾" scale Cleveland-Designed model of the already world famous Boeing 247 type commercial plane which cruises at 180 m.p.h. over many air-lanes throughout the United States. (The one above is a model of one in the Boeing division of the United States Air Lines. Information may be gathered by any builder for making the particular line insignia in which he is most interested. They are not supplied with the Kit).

This photo shows model as in flight with motor sticks in place. The one above as a ground view of exhibition model—both are the same plane.

This beautiful model is capable of exceptionally good flights, for flights of over 250 feet were quite easily obtained with the same model pictured here. We were about as surprised after testing this ship as we were after the Laird Super-Solution was designed. Honestly, we did not think much about its flying ability, although we did know it would make some flights, but after testing it, it flew beyond all expectation. In many cases it reached an altitude of 40 feet, looking just like the big ship itself, only for the fact that the wheels do not retract (which is impossible because of the motors being so low in the wing). Span is 55⅝", length 38⅜", weight 16 oz. Colored all silver.

Powered with rubber strands, and made in the orthodox C-D manner except for the larger structural members such as wing beams which are of the girder type and generally of balsa, paper, music wire, and furnished with standard Cleveland dopes and cements. Motor sticks are removable so when displayed, it looks like an exhibition model.

The Kit comes complete, all materials necessary, including partly finished nose block, ready furnished cowls, completed wheels, stout axle material to withstand the severe shocks (the model weighs approximately 16 oz. ready for flying, you know), all the dopes necessary and extra heavy covering paper.

Complete Kit SF-35.—as described above and including two sheets of drawings (4 panels 17" x 44"), containing every bit of information necessary for building the model, shipped anywhere in the U. S. by express in a strong wooden box 4 x 7½ x 40",

Order Kit SF35 $6.50
Shipping Charges Collect
(Wt. not over 10 lbs.)

(Drawings alone not sold. Foreign customers inquire of steamship companies rate of delivery to your city—we are not responsible for expenses of mis-shipping and must act accordingly).

BARGAINS

YOU MAY NEVER SEE AGAIN

(Good only until October 1, 1933)

Here are some close-out prices, in full conformity with our NRA membership. Some of the values are amazing. The SF-2, for instance, is the same Kit that originally sold for $5.50. These prices are good only as long as present supply lasts. First come, first served!

All descriptive matter on these Kits will be found in Price List No. 11 (not a new one). If you haven't a copy, send 5c for it or No. 12.

¾" Scale Kits

KIT SF-1 (originally $5.50) | KIT SF-6 (originally $2.95)
KIT SF-2 (originally $5.50) | KIT SF-7 (originally $3.50)
KIT SF-13 (originally $4.00) | KIT SF-8 (originally $2.95)
KIT SF-15 (originally $4.00)

NOW EACH $1.75 NOW EACH $1.50

⅜" Scale Kits

KIT JSF-1005 (originally $2.50)
NOW EACH $1.25

⅜" Scale Semi-Profile

KIT FL-302, 303, and 304 (originally $3.30 each)
NOW EACH $1.00

⅜" Scale Profile

KITS FL-101 to 112 (except 106 and 109) originally $1.10 each
NOW EACH 50c

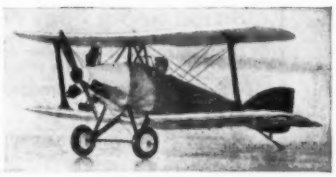
FAMOUS C-D DRAWINGS

All FL-100 line drawings (except 106 and 109), only 15c each. All FL-200 line and FL-300 line (except 301), only 25c each. Drawings for original SF-8, Boeing P12B; the old SF-12, Nieuport Biplane; and old SF-14, Fokker Triplane; the undersize DH-4, and JN-4, only 25c each. Drawings for SF-2 Travel Air Mystery Ship (four very large sheets with plenty of photos); SF-13, the Spad; and SF-15, Fokker D-7; only 40c each.

DEALERS: These items subject to regular discount, according to minimum quantities usually specified. CASH MUST ACCOMPANY ORDER—but no cash discount allowed.

MORE NEW ONES (2 of 'em great favorites redesigned)

ALL THESE KITS HAVE PRINTED-OUT WOOD IN THEM



LINCOLN Sport Plane

The dream ship of many light plane enthusiasts. ¾" scale, and flies beautifully. Span 15", length 12⅛", weight 1 oz. Colored cream and black tail, details and trimming. Complete Kit SF-36 (with everything including printed out wood parts. No pilot included, but you can easily carve one out of balsa) at dealers, or postfree, only $1.50

Buhl BULL-PUP

A neat ¾" scale model—looks far better than its picture. Keen flights. Colored standard yellow wings and tail, balance blue, details black. Span 22½", length 15", weight 1.9 oz. Complete Kit SF-38 (with everything needed, including printed out wood parts—but without pilot) at dealers, or postfree, only..... $1.75

Re-Designed 1931 GEE-BEE

We've re-designed this authentic ¾" scale model that thousands over the world have built. Pictures were not ready at press time—but it's a peach. Colored yellow and black. Span 17½", length 12", weight 1.6 oz. Complete Kit SF-17 (with everything including printed out balsa) at dealers, or postfree, only..... $1.75

Re-Designed HOWARD

A famous C-D Kit liked by beginners as well as old timers—now re-designed. Pictures were not ready at press time—but she's prettier, and simpler to build. Colored all-white, black details. Span 15" length 13¼", weight 1.3 oz. Complete Kit SF-18 (everything including printed out balsa) at dealers, or postfree, only..... $1.50

You're Missing Plenty if you're not getting each issue of

CLEVELAND MODELMAKING NEWS

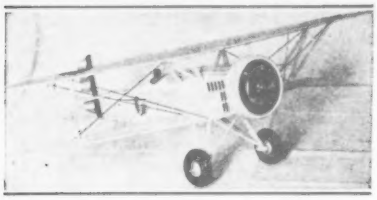
Thousands have already subscribed—and they're sending such compliments as "It's the 'modelbuilder's Bible.'" "Best thing yet on modelbuilding." "Can hardly wait for next issue," etc., etc. Filled with authentic scale drawings, suggestions, ideas every modelbuilder needs. 25c per issue. Issue No. 4 now ready. Send $1.00 for 6 issues (all subscriptions begin with No. 1) or $1.75 for 12-issue subscription (to same address only). Foreign customers, add 5c per issue to above prices. NOW while you're thinking about it—SUBSCRIBE!

NRA MEMBER U.S.

ASK YOUR DEALER for these and other authentic Cleveland-Designed Flying Model Kits. If he hasn't what you want, order direct, giving dealer's name.

CLEVELAND MODEL & SUPPLY CO., Inc.
1866-PAK West 57th St., Cleveland, Ohio, U. S. A.

Curtiss Sea Hawk P3A



24" Span, Weight 1¾ oz., Flies 900 Feet

Set includes 3" celluloid motor, aluminum motor plate and drag ring, balloon celluloid wheels with silver discs, printed instrument board, fuselage, wing and rudder insignia, aluminum pilot's seat, dope, glue, drawing and all materials. Const. Set $2.50

New Curtiss XP934 Pursuit

24" Span, Weight 1 oz., Flies 675 Feet

Set includes semi-finished wheelpants, glistening hollow metal exhaust pipes, strong aluminum wheels, two color dopes, glue, wing and rudder insignia, U. S. Army lettering, detail drawing, ribs, formers, etc., printed on balsa. Const. Set. Postpaid $1.75

Curtiss Super Hawk

20" Span. Weight 1 oz. Flying Model Construction Set, Complete.....$1.00 P.P.

Boeing P12D Pursuit

20½" Span, Weight 1½" oz., Flies 600 Feet

Const. Set includes printed formers and ribs, 3" celluloid motor, celluloid wheels silverized discs, insignias, glue, drawing, fibre prop, color yellow and drab. Const. Set Postpaid.....$1.75

Curtiss Hawk P6E

24" Span, Weight 2¼ oz., Flies 800 Feet

The strongest and most perfect model of the P6E on the market, has squadron insignia on pants and fuselage, metal exhaust pipes, aluminum wheels, 2 color dopes, all parts printed on balsa, etc. Const. Set, Postpaid.....$2.50

New 1933 Illustrated Catalogue 10c

Miniature Aircraft Corporation

82 LOW TERRACE NEW BRIGHTON, NEW YORK

Stratosphere

(*Continued from page 224*)

load ring that will support the gondola which is now moved into place and piled high with bags of lead dust.

Another hour drags by while two men working on top of the gondola secure all ropes and fittings and rig the radio aerial and the valve lines. One line opens the release valve at the top which is kept closed by a spring. Another line controls the appendix opening to allow for further expansion of the gas after the bag is fully distended. The third line is the rip-cord which opens the entire side of the bag and allows for rapid deflation at the moment of landing.

Radio is to play a big part in this flight for not only will Commander Settle broadcast every few minutes during the twenty-four hours he expects to be up, but arrangements have been made to have the balloon followed by a high speed radio truck which will endeavor to be on the spot and broadcast the actual events at the landing wherever it may be.

The hold-down ropes have now been pulled through the fillets and dropped and the balloon is being held by only a few cables looped through the load ring. Now comes the ticklish job of weighing off. Commander Settle takes his place in the gondola and the sacks of ballast are handed out while mechanics fasten the sealed barographs and the parachute to the top of the car.

Then a voice calls for attention: "Commander Settle requests absolute silence for a few moments while he tests the release valve. He must be able to hear the escaping gas from the ground and he asks that you do not talk or move."

An awe-inspiring hush envelopes the multitude as Settle gives a mighty tug on the release cord. Then high up above our heads comes a whispered whistle, like the sigh of a contented teakettle, as the precious gas escapes. The cord is released and the sound dies down. After a consultation the process is repeated and when everything seems to be satisfactory we breathe freely.

A few final readjustments of ballast and we feel that the moment for which we have been waiting so many hours is at hand. We steal a hasty glance at our watch—four minutes past three in the morning! A couple of practice bounces just a few feet in the air and Commander Settle perches himself on the hatch, leans over to kiss Mrs. Settle and waves his cap to the crowd as the ropes are released.

"He's off!"

Our cheers are echoed by the thousands packed in parked cars around the stadium as the giant gas bag with its tiny car glides silently, smoothly up to meet the full moon. Three 8,000,000 candlepower Army searchlights turn their cold, blue gaze on the gleaming white balloon as it drifts gently westward over the city.

WELL satisfied with the night's events we turn our steps toward home and are hardly out of the gates when with a gasp we see the balloon falling rapidly in the glare of the searchlights. After such a brilliant beginning it seems impossible that disaster should follow in less than ten minutes, but there's a steady stream of dropping ballast and she's still losing altitude mighty fast.

Suddenly—darkness! The bag has fallen below the range of the lights, and excited groups of onlookers each with a different theory stand wondering, gazing into a curtain of black silence.

Nothing we can do about it so we hop a street car, but within a few blocks we learn that the radio has just flashed the news that Settle is down at 14th and Canal Streets! That's less than a mile from the starting point and about the same distance from the "loop." Imagine landing the world's largest balloon in the very heart of Chicago's

15-inch Flying Scale Model Kits

Complete with full size plan printed ribs and formers, 2 sheets colored paper, machine carved prop, and balsa wheels. Balsa strips cut to size, ambroid dope, wire, bamboo, etc., packed in gift box.

FOKKER D-VII - 35c Post FREE
CURTISS ROBIN - 35c Post FREE

FREE 250 feet of Finest FRESH PARA RUBBER with Every Order of $1.00 or More. Add 10c postage for FREE Rubber.

18" BALSA STRIPS

1/32x1/16	50 for .05	1/16x3/16	20 for .05
1/16x1/16	50 for .05	3/32x3/32	21 for .05
1/16x1/8	30 for .05	1/8 x1/8	20 for .05
1/16x3/16	20 for .05	1/8 x3/16	14 for .05
1/8 x1/4	10 for .05	1/4 x1/4	8 for .05
1/4 x1/2	4 for .05	1/2 x1/2	3 for .05

18" BALSA SHEETS

1/64x2	5 for .10	3/16x2	4 for .12
1/32x2	7 for .10	1/4 x2	3 for .11
1/16x2	7 for .10	1/2 x2	2 for .12
3/32x2	6 for .10		
1/8 x2	5 for .10		

18" BALSA PLANKS

1"	x1"	1	for .07
1"	x2"	1	for .11
1"	x3"	1	for .15
1"	x6"	1	for .25
1½"	x1½"	1	for .15
2"	x2"	1	for .20
2"	x3"	1	for .25
2"	x6"	1	for .45

PROPELLER BLOCKS

5/8x	½x 5	9	for .05
5/8x	¾x 5	7	for .05
5/8x	¾x 5	7	for .05
1x	¾x 6	7	for .05
5/8x1	x 7	3	for .05
5/8x1	x 8	2	for .05
¾x1¼x10		1	for .03
¾x1¼x12		1	for .04
1 x1¼x15		1	for .07

FOR 36" LENGTHS DOUBLE 18" LENGTHS COST

COLORLESS CEMENT
2 oz., .08 4 oz., .15
1 pt., .25 1 qt., $1.00

CLEAR DOPE
2 oz., .07 4 oz., .13
1 pt., .45 1 qt., .75

JAPANESE TISSUE
White .....18 per doz.
Colored — Yellow, blue, red, green, orange, black, olive drab—ass't. .20 per doz.

COLORED DOPE: White, yellow orange, red, green, olive drab, blue, black silver, gold, 2 oz., .10; 4 oz., .19. **THINNER:** 2 oz., .07; 4 oz., .13. **WASHERS:** ⅛" dia., doz., .01½; gr., .10; ¼" dia., doz., .01½; gr., .10. **REED:** 1/16 or ⅛" dia., 5 ft., 2c. **WIRE:** All sizes, 5-ft. coil, .02. **PARA RUBBER:** 1/32" sq. or .045 30 ft., .05; 3/32" flat, 20 ft., .05; ⅛" flat, 17 ft., .05; 3/16" flat, 12 ft., .05. **THRUST BEARINGS:** Small or large, 1 doz., .15. **BAMBOO:** 1/16" sq. x 10½", 35 for .05; 1/16" x ¼" x 15", 12 for .08. **CELLULOID WHEELS:** ¾" dia., pair, .05; 1" dia., pair, .07; 1⅜" dia., pr., .10; 1⅞" dia., pr., .14. **TURNED BALSA WHEELS:** ½" or ¾", .04 pr.; 1", .05 pr.; 1⅜", .08 pr.; 1⅞", .11 pr.

No orders under 50c. Add 15c for packing and postage to orders under $1.50. Orders over $1.50 add 10%. When ordering 36" lengths add extra 10c. Canada, 10c extra. (10c extra to cover postage on Free Rubber.)

Dealers! Clubs! Write for confidential Wholesale Price List.

Heathe Model Airplane Company
438 E. 98th St. Desk 4 Brooklyn, N. Y.

industrial district! We'd better go and see this.

But thousands of others have the same idea and street car and auto traffic is tied up tight so we take to the hoof. In ten minutes we are on the spot and what a sight it is! We pause for a moment on the 12th Street viaduct to get a panoramic picture of the scene. There on the railroad tracks below us is a milling, shouting crowd of humanity pressing around a tiny white ball that we recognize as the gondola. The collapsed envelope must be there, too, but we can't see it in the dim light of the switchyard floodlights. But let's get on down to the spot for some close-ups.

"Where's Settle——?" "Was he killed?" asked a calamity howler hopefully. "Naw, he's O.K." "Well, but ——" "Gangway for the cameras, you punks!" "Pardon me, that's my foot —why, hello, where did YOU come from?" and lots more of the same good-natured bedlam let loose.

A few minutes observation assures us that Settle is uninjured, the gondola is only slightly damaged and the bag was rescued before too many souvenir hunters got their knives into it. The fabric is being rolled up in preparation for a salvage train which will come and pick it up.

Newspaper accounts of the forced landing differed somewhat as to its cause. From Major Chester Fordney who was one of the first to reach the gondola and who superintended the salvage operations, we learned that the release cord had not been touched and that Commander Settle believes that the release valve had never fully closed after its test, and that he took off with the valve partly open. The movement of the bag as well as the friction of the partially collapsed lower part of the envelope on the cord could have opened the valve in flight. At any rate the cause of the descent must be laid to some faulty arrangements of this valve or its parts. END.

12" Ornamental Models

Photograph of the Hawk P-6-E Model

AT LAST. A striking, true scale reproduction of the famous CURTISS HAWK P-6-E and GEE BEE SUPER SPORTSTER at a price that you can afford. Each an art piece of rare beauty and distinction.

AMAZINGLY large and most complete CONSTRUCTION KITS to build these beautiful models for pleasure or profit are now available at the following SPECIAL PRICES: Curtiss Hawk P-6-E 12" Kit, only $1.70 each. Gee Bee S. S. 12" Kit, only $1.80 each. Postage 20c per kit extra. Please remit by Money Order or Check. Stamps not accepted.

Satisfaction Guaranteed or Money Refunded

RUSH 5c for new illustrated descriptive folder and prices of 12" and 20" Finished Models, Kits, and Drawings. Actual photographs only 10c each.

VICTOR STANZEL

High Grade Model Aircraft

SCHULENBURG TEXAS

SELLEY *Introduces*

8 NEW KITS 50c each

Postage 10c

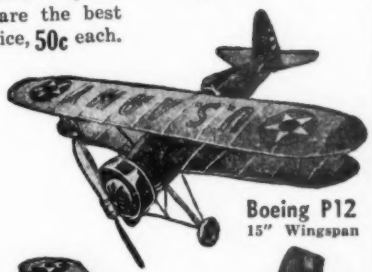
Flying Model Kits

Never before have such values been offered. Professionally designed and flight tested for performance, these are the best flyers Selley has ever produced and at such a low price, 50c each.

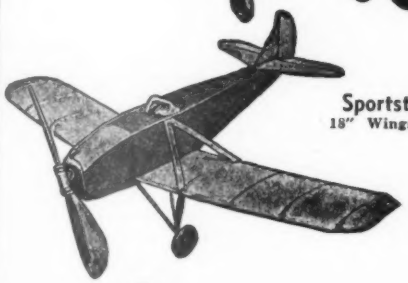
Bat 18" Wingspan

Hawk P6-E 15" Wingspan

Swallow 18" Wing

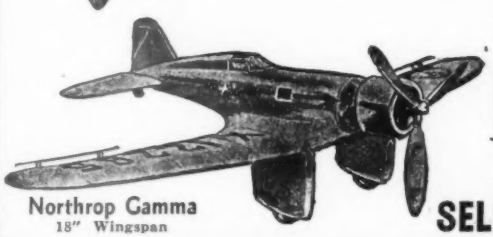


Boeing P12 15" Wingspan



Sportster 18" Wingspan

Vought Corsair 15" Wingspan



Northrop Gamma 18" Wingspan

Lockheed Sirius 15" Wingspan

BAT
SWALLOW
SPORTSTER

These Commercial Contest Models with 18" wingspan are sensational in their flights. Over 300 feet are **guaranteed** with these snappy **Large** long distance flyers, with their large slow winding propellers and bright colors. These models are the choice of the most critical model builder and judge. **50c each 10c Postage.**

Hawk P6-E
Boeing P-12
Vought Corsair
Lockheed Sirius
} 15" Wingspan

Northrop Gamma 18" Wingspan

These dandy scale Flying model kits are remarkable in their performance. Each kit is complete with special turned parts printed balsa sheet, spray balsa, colored jap paper, rubber, cement, insignia and everything to build a complete model.

Any model kit complete 50c 10c postage.

SEND FOR YOUR KIT TODAY and remember All SELLEY products are **guaranteed** and may be returned if not entirely satisfactory. **Ask your dealer for SELLEY KITS AND SUPPLIES.**

Add 10c Postage for each kit, 15c if west of Denver. Send 5c for complete supply catalog, 10c for kits, supplies and Free Plan.

DEALERS: Write for discounts. We can supply boat supplies, cleats, chocks, anchors, propellers, etc.

SELLEY MANUFACTURING CO., Inc.,
1373 P Gates Ave., Brooklyn, N. Y.

Model Contest

(*Continued from page 228*)

home and took him to the Newark (N. J.) airport from which the United Air Liners leave for the west. Once at the airport, he made the necessary arrangements at the ticket office, and soon was whirling on his way to Seattle.

Having travelled to California by rail, several years before, the tremendous speed made by this twin Wasp powered monoplane seemed marvelous to him by comparison. At 12, midnight, they arrived at Omaha and at 12:30 p.m., the following day, the plane landed at Los Angeles, Cal. And finally, at 4:25 p.m., or slightly more than 24 hours since he left New York, the plane arrived at Seattle, his destination.

A cab took him from the airport to the hotel where he had his supper and prepared for a big time at the Boeing factory on the following day. Taking stock of himself, he had travelled over 3,000 miles, had been on his way 24 hours and so far had not parted with a penny of his own.

On the morning of January 4, he was taken to the Boeing plant to view the building of planes on a big scale. Here he saw both military and commercial aircraft in production and followed the manufacturing operations from the drafting board to the final test flights of the finished product. He learned how the "247's" were built and saw the elaborate system of tools and fixtures necessary for volume production. It was highly educational and at the same time, tremendously interesting to a full fledged air fan. In the evening he went to the theatre with some Boeing officials, but so engrossed was he with the plant, that he could hardly wait until the second and last morning of his visit.

And then came the time for his departure. He was reluctant to go, after his aeronautic jamboree, but all things must come to an end. A cab called at his hotel, took him to the airport and once more he was on his way at 9:55 p.m. After a day and a night we find him landing at Newark airport at 10:20 a.m., just a little over 24 hours from Seattle. Over 6,000 miles in slightly more than 48 hours—the marvel of the present day.

After the cab left him at the door of his home, he felt around in his pocket for his keys, and thereupon discovered the same dime and quarter that he had started out with. The trip hadn't cost him a cent, but he was about 100 years older in the experience and knowledge that he had gained in these few days. Was this worth the time and energy expended in building a model? He thinks so and so do we and as a reminder of this wonderful experience he still carries the gold medal awarded by POPULAR AVIATION.

Now, Richard had a somewhat different problem to solve as his second prize entitled him only to a 3,000 mile trip—out and back. Again, he did not live at the terminus of the air line, but at an intermediate point, Rockford, Ill., about 75 miles from the Chicago Municipal Airport from which the planes of United Air Lines operate. It was difficult to choose a route from this point, but he carefully studied the accompanying map and worked out a number of plans. If he went to New York, the total distance would be approximately 2,000 miles. If he took a plane to the Southwest, say to Dallas, the distance would be even less.

Then he looked toward the west and discovered that a trip to Salt Lake City, Utah, would just about make the 3,000 miles. He had always longed to see the West, and as he had already been in New York, he finally decided upon the Salt Lake City trip which was particularly appealing because it was to be taken during the early summer. To make matters short, he was advanced his railroad fare to Chicago, and on arriving at Municipal airport he boarded a westbound plane that left Chicago at 5:00 p.m. This trip of about 1,500 miles was accomplished in a very short time for he landed at the Salt Lake City airport at 2:18 a.m. on the following morning.

After a day spent pleasantly in Salt Lake City where, by the way, are many things to see, he left for Chicago and his home town, Rockford. And, as with Joe Doe, close auditing disclosed the fact that his trip had cost him nothing.

And so we close the hypothetical travels of John Doe and Richard Roe, which will serve to answer many of your problems should you be so fortunate as to win one of these wonderful prizes. From time to time we will publish more information on this subject for the contestants and the prize winner. *But don't forget that this contest closes on December 15, 1933, and that no entries will be received bearing a later date-line.*

END.

Balbo

(*Continued from page 232*)

carburetion is supplied by six Stromberg carbureters, two carbureters to a bank.

The total piston displacement is 2,880 cubic inches while the normal output per engine at 1,750 r.p.m. is 880 b.h.p. The maximum output obtained at 1,900 r.p.m. is 940 b.h.p. The weight per horse-power is 1.66 pounds.

Forced water-circulation for the cooling system comprises a centrifugal water-pump which supplies the water to two independent radiators for the engines. The radiators for the front and rear engines can be removed independently without disturbing the other unit in case of accident.

At normal output, the gasoline consumption is 0.475 pound per horsepower-hour or 1.37 gallon per mile. The corresponding lubricating oil consumption is 0.022 pound per horsepower-hour which shows a gasoline-oil ratio of more than 20.

Judging from the "Red-Bullet," world's record speed plane, and the present Marchetti boats, Italy is establishing a practice of tandem propellers. The propellers are of the three-bladed type having an adjustable pitch which can be varied only with the engines at rest. It is said that nearly one hundred different propeller combinations were tried out before the present propellers were arrived at.

Getting back to the airplane construction and particularly the tail group construction, we note that the vertical surfaces are in three groups. There are two vertical fins at the outer end of the stabilizer, each fin carrying an unbalanced rudder. The center surface is a balanced rudder that is used for normal maneuvering. The fixed horizontal stabilizer is carried directly by the outriggers and to this surface is attached the balanced elevator.

During flight, the engines are easily accessible to the mechanics, who can stand by the hood and make the necessary adjustments as with the engine of an automobile.

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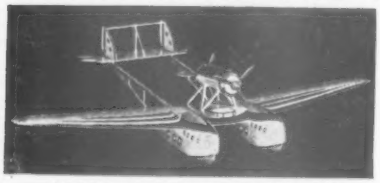

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401 S. W. Rimac Bldg., Los Angeles, California

Q & A

(*Continued from page 240*)

paper or else cover the kite cloth with copper or tin foil. A good strong kite string should be used around which a thin bare copper wire is wound, the wire being connected with the foil on the kite. This will form a conducting surface.

* * *

QUESTION:—Harry Schumaker, South Bend, Ind. *Does a dihedral angle increase the drag of a wing? If so, why?*

Answer:—THE ordinary dihedrals do not make a great deal of difference, but when this angle is much above 5° (on each side), the drag will be noticeably increased. This is due to the fact that the lift force created by the wing is perpendicular to the wing, while the vertical load is no longer parallel to the lift line. The lift line therefore is the resultant of two forces so that it is greater than the load, hence greater pressure and greater drag.

* * *

QUESTION:—Charles DuBrock, Elgin, Ill. *What is the difference between torsion and bending stresses on a wing structure?*

Answer:—BENDING stresses, similar to the stresses in a lever, produce compression stresses on one side of the member and tension on the opposite sides. This is also similar to the bending of a beam or a rafter in a house. Torsion, which means twisting, is similar to the stresses produced by rotation in a shaft. These are true shearing forces that tend to slide the surfaces over one another in a plane perpendicular to the axis.

* * *

QUESTION:—Elie Sampson, Minneapolis, Minn. *I am thinking of using a four-bladed propeller on my Ford "A" powered lightplane. Do you think that this would give me more speed?*

Answer:—NO. WE do not recommend a four-bladed propeller for such a small power plant. Such a propeller would be less efficient than the two-blade type, would be much more expensive and it would not add to the performance.

* * *

QUESTION:—Thomas H. Brooks, Los Angeles, Cal. *How much overhang should be given to the top wing of a biplane? Is there any rule for this proportion or will any percentage do?*

Answer:—THE overhang of the top wing is made equal to the chord or possibly one chord and a half in extreme cases. Overhang is more effective with a small gap than a large one, and if the gap of the plane is more than 1.2 times the chord, the advantages gained by overhang are small considered from the standpoint of performance.

* * *

QUESTION:—A. C. Didier, Lebanon, Ohio. *Is the lift of a dirigible entirely due to the gas, or does the engine contribute to the lifting power?*

Answer:—UNDER normal operation, the gas contributes most of the lift, say about 95 percent. The remainder is provided by the engines, the bottom of the hull acting like the wing of an airplane. By this distribution of lift, the ship is made much more maneuverable.

* * *

QUESTION:—Lester Knapp, Rye, N. Y. *How much does a retractable landing gear add to the speed of an airplane?*

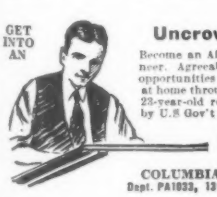
Answer:—ANYWHERE from 5 percent to 25 percent depending upon conditions. At speeds below 100 m.p.h., the use of a retractable gear is hardly justified, but at increasingly high speeds, the retractable gear becomes more and more important in its saving of power. At 200 m.p.h., it is likely that the average retractable gear on a transport type plane would increase the speed by at least 15 percent and perhaps more.

* * *

QUESTION:—Al T. Quelle, Atlanta, Ga. *Which takes the most power with an airplane, adding weight or adding head resistance? What I mean is this. If a certain device saved one pound head resistance, how heavy could it be made before it would offset its advantages?*

Answer:—TAKING the lift-drag ratio of the average airplane at 12, it will be seen that 12 pounds of weight will produce one pound of drag. Thus, we could add 10 pounds of weight and still show a saving.

END.



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Boeing "247" Model

(*Continued from page 258*)

The fin, the rudder, the stabilizer and the elevators are similar in construction. The stabilizer should be constructed in one piece and attached to the body before the final covering has been completed. The elevators hinge along the centerline which runs directly into the small off-corner of the stabilizer. The position of the hinge at this point permits a circular construction of the front of the elevators and gives them a perfect streamline form at various angles.

The construction of the rudder is the same with the hinge running through the small section of the fin. All control surfaces are faired to the body and do not butt squarely against the sides and top of the fuselage. A small block of balsa should be employed near sides of the body for the stabilizer and near the top of the fuselage for the fin.

END.

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5/8x1 x7"	.18
3/4x1¼x10"	.27
3/4x1¼x12"	.30
1 x1½x15", ½ doz.	.28

Bamboo	
1/16 sq. x10½", gr.	.13
1/16x1/4x15", 2 doz.	.12

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1 pint	.40
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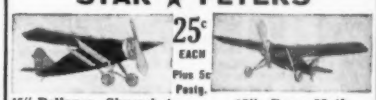
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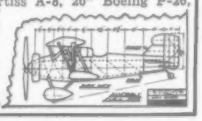

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3/16x3/8 ,	8	5c	1 x1½x12,	1	.5c
1/4 x1/4 ,	19	5c	5/8x1 x8,	3	.5c
1/4 x1/2 ,	5	5c	3/4x1¼x12,	1	.3c

1/32x2,	8	....	10c
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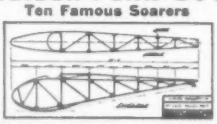

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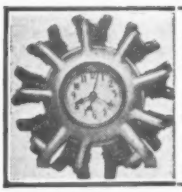

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Aero-Sportswomen

(*Continued from page* 244)

the highlights takeoff for new lands to conquer. I think it is just about the perfect way to study history, geography and democracy. What say?

"As to the whys and wherefores of Moscow," she goes on to say, "Dad is, according to the terminology of the Russians, a 'foreign specialist' . . . . Gee Joan, life here was so completely different from what we had been brought up to expect it to be—everything was so new and exciting—it was a riot, every minute had its 'moment.' Only got a lot of promises from the aviation authorities when I asked if I could fly. The nearest I came to flying that year was when I made some vile black coffee for Amy Johnson when she flew through here on her way to Tokio and the all-night vigil waiting for Herndon and Boschorn."

After a year in the Soviet, Fay came back to the States for about six months but returned to Moscow and has had many interesting experiences in the past two years. She said she did get to fly once just before she left, but only because they knew she was leaving and they didn't expect her back. Then last February she was asked to give a lecture on parachutes before the students of the Moscow Civil Aviation school.

She has had an opportunity to travel extensively through southern Russia and the Ukraine and thinks it is the most fascinating place in the world.

"You can't help liking the Russian peasants," she said, " they are all just like children, so natural and unsophisticated, but they can be so exasperating! You can't believe them, they will tell you anything they think you want to hear. If you ask them how far it is to a village and you happen to look tired, they will tell you it is just around the corner or over the hill—anything to cheer you up. And their singing—from grandson to grandpa they all have natural voices and instinctively they harmonize in their own inimitable way—and my dear, when the Red Army goes marching down the street singing 'Partisan'!

"Things over here are so darn contradictory, one day you think this place isn't so bad and the next you are sure you won't be happy until you have a one-way ticket home. The stories I could tell you might be just exactly the opposite from what someone else who had been over here an equal length of time might tell, and they both would be right.

Miss Gillis reports that there are girls in all branches of the soviet aviation from mechanics to flying the mail. As there is no official record available she has not been able to find out how many pilots there are, however she does not believe it is a very large number. In the picture taken at the Moscow civil airport, which she sent with her letter, the girl on her left is Laylu chnum Mamedbekova, the first Turkish woman to be admitted to the Soviet air corps. Laylu was sold in marriage when she was thirteen but her husband who later became a communist persuaded her to take off her veil and help emancipate the women of her race. She is now a flying instructor in Baku.

Fay says there are any number of stories like that over there, however, she does not advise all the unemployed pilots rushing off to Russia to join the air corps—at least without due consideration!

* * *

AFTER breaking the world's light-plane endurance record by more than two hours at the Youngstown, Ohio, municipal airport in June, Mary Campana, five-and-ten-cent store clerk, was forced down by an electrical storm. Her record is a little over 13½ hours. The previous world record had been 11½ hours.

END.

Air Mail Pilot

(*Continued from page* 236)

He eased her off the bumps the very first night the line opened, May 1, 1928, and he knows every mosquito and its grandchildren over the swamps that dot the terrain under his air-lane. Now only one of the five original pilots on that line is left—Gene Brown, handling the Richmond-Atlanta schedule.

Amberse Banks dropped off the active list, Sid Molloy and John Kytle are dead. Maybe it's luck, and maybe it's something else, that Treat's name isn't carved in marble some place, but it's only over a garage door. He surely seems to have gotten the breaks.

Before the war, he wing-walked on Ruth Law's plane and he used to do that same fool stunt, with his feet strapped on, while she looped her old crate. During the war he learned the joy stick stuff on his own, and until 1921 he was a commercial pilot, which job he quit for the garage business in Asbury Park, N. J.

This time he swears he'll inhale his ethyl at the pavement level from hence forth. It may be a good hunch, at that. For a long time he was both the luckiest and unluckiest pilot on the night mail. He has put his ship down in rough country, with the night piled around him like black wool, and never scraped a shin. Balky motors have put him on the spot time and again, but he's cheated the angels every time.

Twice he has taken to his 'chute, once at 11,000 feet when out of gas in a fog, once when his ice-covered wings slipped into a spin at low altitude. That was six miles north of Laurel, Maryland. His ship was not much for service when it hit, but he eased into a tree and called it a day. 6,000 air-hours and more, is a mark to shoot at. And the small, modest, quiet Verne Treat is now just plain John Citizen, lading out gas and repair bills. It doesn't seem reasonable. It isn't.

END.

Placing Wings

(*Continued from page* 251)

In Fig. 5 we see why most parasol or high-wing monoplanes have been safe. The strong pendulum action, with the center of gravity well below the wing, is a good safety feature for it causes a diving moment at all locations of the C.GF. up to the 42.5 percent curve. The 42.5 percent curve shows that the combination almost balances at 16 degrees so it could be used.

In conclusion it seems that the safest and easiest types for the beginner to build is the high-wing or parasol monoplane.

END

Insignias

(*Continued from page 236*)

horse, harness yellow, red devil, yellow background, brown fork, superimposed on diamond; upper half, blue; lower half, green.

30th Bombardment Squadron—"Sergeant Branner," blue with black and yellow trimmings, and shoes in black border. Compass points green.

28th Bombardment Squadron—Indian Head, brown, yellow head band, yellow ribbon on hair, yellow beads. Black hair, ears and whiskers, white eye with black pupil, face markings red piped with yellow, red mouth, blue feather tipped with red—blue diamond.

35th Pursuit Squadron—Silver oval within a blue border, a black panther, tongue red.

72d Bombardment Squadron—White clouds and lightning on circular background of black.

20th Bombardment Squadron—Pirate with tanned face, tan arms, black moustache, red cap with white stripes, yellow jacket, black cape and bomb; pants, shoes and stockings, brown. Alternate green and white stocks. Red bomb with two black bands, 11 black crosses on white field, all on rectangular white background piped in black.

96th Bombardment Squadron—Red devil, white aerial bomb. Black triangle with white edges.

23d Bombardment Squadron—Black volcano, with red lava flow, black bombs, white clouds, futuristic rays, alternate orange crimson and yellow, piped with white, all superimposed on circular blue background.

13th Attack Squadron—Dark blue field, white skeleton, yellow scythe with bloody blade.

77th Pursuit Squadron—Natural.

5th Observation Squadron—On blue disc piped with yellow, a yellow moon and 5 stars. Owl proper, silver telescope.

4th Observation Squadron—A cross estoilee divided per saltire and per cross gold and blue.

49th Bombardment Squadron—Gray wolf's head, red tongue, against orange disc edged with gray.

17th Pursuit Squadron—Owl, white on black field.

7th Observation Squadron—Blue diamond piped with red, white sword, and shield outlined in black, black portcullis.

6th Pursuit Squadron—On a circular orange field, a gray skull outlined in black forming the hub of a shaded spinning propeller done in black.

25th Bombardment Squadron—Man, proper, dressed in black, black masked, nose tip and sash, red; gray axe with bloody blade; on circular white background, piped in black.

36th Pursuit Squadron—Cloudlike background of golden orange, bordered in blue, blue helmet and white goggles with black rims. Figure brown with bloody tongue.

15th Observation Squadron—Pigeon, proper, telescope white trimmed in black, shield blue above, yellow below.

90th Attack Squadron—Red dice outlined in white with white spots.

88th Observation Squadron—Rider and horse in black silhouette on orange disc.

12th Observation Squadron—Orange disc, hawk in deep gray, white head, black projectile.

END.

Practical Lessons

(*Continued from page 246*)

wind. However, since the winds blow in different directions at different altitudes, it is possible to obtain some degree of directional management by increasing or decreasing the altitude of the balloon until a wind of the proper direction is found. This procedure, however, shortens the duration of the flight because it requires a sacrifice of gas, ballast or both.

When the altitude is to be increased, the weight of the balloon is reduced by discharging ballast. When the balloon is to descend, the proper amount of gas is discharged through the gas valve at the top of the envelope. The poise of the balloon is remarkably sensitive to the discharge of exceedingly small amounts of gas or ballast and a few ounces difference, either way, produces a considerable variation in altitude.

Owing to atmospheric variations, such as temperature changes, air density variations, or vertical currents of air, the balloon seldom maintains a constant altitude of its own volition but requires occasional correction by means of the ballast or gas.

Sun striking the bag or the heat rising from flat prairies, expands the gas and causes it to ascend while a passing cloud, shading the balloon, reduces the temperature and causes it to descend. Thick forests, bodies of water or similar cool areas on earth, reduce the temperature with similar effects so that the natural course of the balloon in respect to altitude is a weaving irregular line as in Fig. 7. Extreme variations, of course, must be corrected by valving the gas or discharging ballast, as when caught in vertical currents passing over hills or mountains as indicated at (E-F-G-H-I).

EFFECTS OF BAROMETRIC PRESSURE

All estimates made on balloons are based on a sea-level pressure of 760 mm. (or 29.92 inches of mercury pressure) at 60° F. However, at higher altitudes, or different barometric pressures (constant temperature), the lift is affected in proportion to the change in pressure. This is a direct relation, easily calculated. For example, if a balloon has a lift of 2,000 pounds at a sea-level pressure of 29.92 inches, then the lift at a barometric pressure of 26 inches (constant temperature), becomes:

$$\text{Lift at 26 inches} = 2{,}000 \times \frac{26.00}{29.92}$$

$$= 2{,}000 \times 0.87 = 1{,}740 \text{ lbs.}$$

The density ratios, corresponding to the pressure ratios, can also be used in the same way when they are available.

The pressure and density at various altitudes can be computed but the formula is rather complicated since the relation is logarithmic.

EFFECTS OF TEMPERATURE CHANGE

Gas expands with an increasing temperature and gives increased lift (pressure remaining constant) while a decreasing temperature causes the gas to contract and become more dense, thus decreasing the lift. If the temperature of the gas in increased 1° C., above that of the atmosphere, the lift is increased 0.036 per cent with hydrogen gas. This corresponds to a rise of about 7 feet. If the temperature of the atmosphere increases 1° C. above that of the hydrogen gas, the balloon will drop about 100 feet while the lift will fall about 0.4 per cent. The variations are greater with coal gas.

PURITY OF GAS

The purity of hydrogen gas can be given as the percentage of pure hydrogen in the gas, which varies from 80 per cent to 99.8 per cent. If the impurity is air, this air gives no lift, hence the percentage of lift will be the same as the percentage of pure hydrogen. For example, if the purity is 90 per cent, then the lift will be 90 per cent of the lift attained with pure hydrogen.

It should be noted that the purity of a gas decreases continually, due to osmosis, and the gas loses lift from the time of inflation.

THE EFFECT OF HUMIDITY

Humidity, or the percentage of water vapor in the air, does not have a very great effect upon the lift, although the water vapor has a decided effect when allowed to mix with the hydrogen. As water vapor is lighter than air, atmospheric humidity will decrease the lift about 0.3 pound per 1,000 cubic feet of gas. Thus, if the bag contains 30,000 feet of hydrogen, the maximum humidity will reduce the buoyant force by: $30 \times 0.3 = 9$ pounds.

TOTAL CORRECTIONS

The following formula for making the total corrections necessary for pressure, density, humidity, and purity is simple. It gives the corrected lift per 1,000 feet of hydrogen gas under the various conditions.

Corrected lift per 1,000 cu. ft.=

$$\frac{12.00 \times \%\ \text{Purity} \times \text{Barom. in inches}}{460 \text{ plus temp. in Fahrenheit degrees}}$$

Let us say, for example, that the purity of the gas is 90 per cent, that the barometer stands at 26 inches of mercury and that the air temperature is 10 degrees Fahrenheit. Then the lift of 1,000 cubic feet of the gas, under such conditions will be:

$$\text{Lift per 1,000 cu. ft.} = \frac{12.00 \times 90 \times 26}{460 \text{ plus } 10}$$

$$= 59.8 \text{ pounds.}$$

And thus ends our lesson on the subject of aerostatics and balloon theory which will be succeeded in our next issue by the elements of airplane wings and wing sections.

END.

BARTER AND EXCHANGE

Good Opportunities for Our Swappers

The publishers reserve the right to reject any or all notices that are not in accord with the policy of this magazine. Only trades or "swaps" will be permitted. For cash deals, buying or selling, refer to our Buyer's Directory. Readers are urged to use caution in arranging trades and references should be mutually exchanged.

AIRPLANES

CANUCK, just completely rebuilt and in excellent condition. Wings just rebuilt but uncovered. Complete set of instruments, dual controls, Lockheed type windshields. Motor not included. Will trade for a smaller plane, outboard outfit, good car or what have you?—C. J. Tippett, 127 Madison St., Port Clinton, Ohio.

LIGHTPLANE WANTED in fair condition. Will trade a Ford "T" runabout in good condition, Remington typewriter, S & W almost new, shot-gun, B-flat clarinet and many other things. —LaVerne De Forest, 280 N. Cedar St., Galesburg, Ill.

OX-5 MONOPLANE, Jenny fuselage, Allison wing, 2-place, duals, several instruments. Ideal plane for building up time, in fine condition and has always been hangared. Photo on request. Would like an Indian Scout motorcycle.—J. Kenneth Corbin, Stamford, Conn.

AIRPLANE WANTED, Monoprep-Inland, Eaglet, Aeronca or other lightplane in good condition. Can use good OX open job if good, need not be licensed. Will trade 1929 Model "A" coach renewed and cash.—Francis Smith, 4703 S. 24th St., Omaha, Nebr.

OX-5 PLANE in good condition, welded steel fuselage, monoplane wings, excellent design. Many engine and airplane parts. Will trade all for a plane in good flying condition.—H. Amman, 3634 Lafayette St., Denver, Colo.

ARROW SPORT, 60-2A, LeBlond, in good shape and can be licensed. Built in 1929. What have you to trade in the way of airplanes or cars?—Harold L. Cox, Waterville, Kan.

LIGHTPLANE WANTED, preferably Aeronca or Bull-Pup. Will trade Nash 2-door sedan in A-1 condition.—Write John Kitzrow, Jr., 1022 61st St., Kenosha, Wis.

AIRPLANE WANTED, dual control. Must fly. Will trade Harley-Davidson motorcycle, 1928, "74," savage automatic pistol, tatooing outfit, watch, wrestling course, etc.—William W. Chuhka, 422 Center St., Freeland, Pa.

AIRPLANE WANTED, one or 2-place job, licensed. I have an Indian scout, 1929 model, aviation course, short-wave set, rifle, skates, movie projector and films. Can add some cash. —Joe Michon, Jr., Box 202, New Hampton, Orange County, N. Y.

LIGHTPLANE, high-wing, O. C., with Harley twin engine. Complete. What have you? Will trade for a heavier lightplane with Velie or LeBlond engine. Will add some cash.—Ervin Larson, Willmor, Minn.

CABIN PLANE WANTED, licensed two or 3-place, 130 h.p., and also a used coupe in good condition. Have for exchange, an almost new 1932 8-cyl. Buick in perfect condition. I will pay difference in cash depending upon offer received.—Oscar P. Wegner, 80 Broad St., New York City, N. Y.

LIGHTPLANE WANTED. Flying Flivver, Air-Camper or similar type. Must be flying at the present time. Will swap light-weight Model T engine, uncovered used wings with 5 ft. chord, pair 26 x 3 wheels, I. C. S. library books on illustration and cartooning, home-shop woodworking set and other things.—H. A. Duncan, P. O. Box 581, Beaumont, Texas.

AIRPLANE EQUIPMENT — PARTS

WANTED. A used Pietenpol Air-Camper tail assembly. Will trade a A. S. P. A. home study course in aviation, Stevens bolt action repeater and some books.—Orville Bolstad, Northwood, North Dakota.

AIRPLANE PARTS, Standard, Jenny, Waco, Tommy, D. H., Rotary engines, new and used: Curtiss Falcon wing, bolts, tires, tubes and other items. Will trade for a small engine. What have you?—A. Jones, Schertz, Texas.

PARACHUTE WANTED, in fairly good condition. It may have a few repairable holes. Either cotton or silk. What do you want?—J. A. McGill, 3300 N. E. Knott St., Portland, Oregon.

HELMET WANTED. Will trade a new Tark electric razor for a summer helmet with ear pockets. Size No. 7 or medium. Must be good. —Harry J. Johnson, Route 2, Box 31, Lemont, Illinois.

LIGHTPLANE FUSELAGE WANTED, an outboard motorboat or motor, an auto radio, typewriter or anything worth while. I have many things to swap. Send in your cards or letters telling what you have and what you want.—William Jeffries, 30 John St., Sheatown, Nanticoke, Pa.

AIRPLANE PARTS, a welded Heath fuselage, welded Homer 3-place cabin fuselage with tail assembly and landing gear complete, an OX-5 engine, Homer monoplane wings, 12 motorcycle motors, Harley twins, 10 motorcycles in running order, 4 Smith wheels, 18 ft. Sailplane, Monocoupe tail-group (except rudder), camera, shotguns, rifles, radios and thousands of radio parts. —Ken. J. MacDonald, 1409 S. Townsend St., Syracuse, N. Y.

CURTISS ROBIN PARTS, cabin door, 1-Oildraulic strut, left axle with fairing, complete tail skid assembly, rudder pedals and two short wing struts. Will trade for most anything. What have you?—J. W. Hunt, P. O. Box 70, Martins Ferry, Ohio.

A CHARGE of one cent per word will now be made for all advertisements entered in the Barter and Exchange columns. Please enclose remittance on this basis when submitting copy.

POPULAR AVIATION
608 S. Dearborn St.,
Chicago, Ill.

WHEELS AND TIRES, new, 24 x 4 S. S. wheels, tires and tubes with 6-ft. axle. A new Bosch magneto, 6-cyl. type. What have you?—L. J. Luchan, 306 E. Center St., Shenandoah, Pa.

FITTINGS for wings and fuselage. Jenny landing gear parts, turnbuckles, hinges, horns, cables and many other parts. I will trade them for a small engine.—A. Jones, Schertz, Texas.

AUTOMOBILES

1928 CHRYSLER (62) Sport Coupe with Rumble seat. Want a good two or 3-place plane in even trade.—E. Carrol Kelley, Box 43, Whitesville, Ky.

1929 CHRYSLER DeLuxe Sedan, Model 75, in perfect condition. Will trade for a light airplane that is licensed or can be licensed easily at small cost.—Murray Ludwig, 30 Oakwood St., Dorchester, Mass.

1928 DODGE TRUCK, 2 ton, 6-cyl., to trade for a good two or 3-place ship.—Charlie Cullor, Unionville, Mo.

1928 FORD ROADSTER in good condition. Will trade it for a lightplane or glider.—G. M. Permenter, 320 E. 5th St., Jax, Fla.

1931 BUICK, 7 pass., Master-8 DeLuxe 4-Door sedan. Has had only 18,000 miles, 6-wheels, trunk rack, new tires, absolutely perfect. New Duce, black trimmed in cream, valued at $650. Will trade for a Bird, Great Lakes, Waco, or Fleet. I also have the wings and fuselage for a Heath low wing monoplane. Act quick.—Louis Stenger, Bartow, Fla.

1932 CHEVROLET SPECIAL, 4-door sedan, special paint job, green body with silver wheels, 15,000 miles, 2 spares, 6 new Goodrich tires, Majestic radio, shatterproof windshield wings, trunk, musical horns. Value $550. I also have a set of Goodrich airwheels, size 7.50 x 15, for this car. Will trade or sell separately. I want a Great Lakes, Fleet, Waco or Bird.—Louis J. Stenger, Bartow, Fla.

BOOKS AND MAGAZINES

MAGAZINES. I have copies of POPULAR AVIATION, Aero Digest, Model Airplane News, etc., a total of over 50 magazines. Also have model planes and kits, and a radio "A" and "B" eliminator. What have you?—Henry Sevcik, Jr., 146 Chestnut Ave., Bogota, N. J.

MAGAZINES. I have about 50 assorted aviation and mechanical mags. Would like to trade them for lightplane plans, books or magazines. —George Hamilton, Cuba, Mo.

MAGAZINES. Have 34 magazines, war relics of all sorts, airplane relics, photos of all sorts of airplanes, Stewart and Warner Radio complete. Will trade for aviation magazines, photos or an aviation course.—John C. Wyatt, 1920 Belmont St., Bellaire, Ohio.

BOOKS WANTED. I want two books, (1) Aeronautical Textbook by Alexander Klemin, and (2) Military Airplanes by Grover C. Loening. Will trade blueprints for the Guardian lightplane and the Tubbs Henderson conversion. —W. N. Hammond, St. Francis Hotel, 9th at Holmes, Kansas City, Mo.

BOOKS. I have almost a new book, Aviation Engines by Page, and the Aeroplane Speaks. Will trade for books on stunt flying or what have you?—David F. Flinders, 1381 Murphy's Lane, Salt Lake City, Utah.

BOOKS. Have 9 Steinmetz electrical library books, and seven reel movie. Will trade for small gas engine, accordion or other things. What have you?—Earl Goddard, Box 83, Mesilla Park, New Mexico.

MAGAZINES. Have 27 issues of Forest and Stream, 53 Outdoor Recreation, 65 Outdoor Life, 70 Field and Stream, about 40 miscellaneous outdoor magazines. Some of them go back to 1923 and are complete by years. I want Savage N. R. A., 0.22 rifle in good condition. What have you?—C. W. Schoch, 410 E. Hoffman, 3-Rivers, Michigan.

MAGAZINES. I have about 22 POPULAR AVIATION magazines that I would like to exchange for a good helmet and goggles.—Chas. O. Baker, Westminster, Md., R. F. D. 10.

CORRESPONDENCE COURSES

SELF-INSTRUCTION COURSES in boxing, chalk-talking, mind-reading, strength building, hypnotism, ventriloquism, also 50 and 75 pound exercisers. What have you? Send list to swap. —Dale Fuller, Clark, S. Dak.

TAXIDERMY COURSE, cost $40. Will trade for a shallow water diving helmet. Helmet must be in good condition.—Alfred Cheney, Jr., 217 E. Blount St., Winston, N. C.

AVIATION COURSE, Dayton School, 60 lessons, cost $70. Like new. Will trade for a motorcycle in good condition, or what have you?—Earl H. Friddle, Route 1, Stokesdale, N. C.

A. S. A. COURSE, "Aeronautics" by Lusk and a set of Heath Model V blueprints and instructions. Will trade for a converted Henderson engine, short-wave radios, aviation books or what have you?—Frank Baumstark, 313 Glen Ullin, N. Dak.

AVIATION HOME-STUDY COURSE, American School of Aviation. 50 lessons complete with blue-prints supplementing lessons, also bulletins. Cost $60. Will trade for a used Heath B-4 engine in fairly good condition.—C. J. Lester, 414 S. 3rd Ave., Durant, Okla.

(Continued on next page)

XUM

ENGINES — MOTORS

BICYCLE ENGINE WANTED, any kind, any condition. Will trade a good 3-cyl. compressed air motor with 30 inch tank, also a construction kit for Boeing P-12-B, lots of good plans and books.—Emsie W. Thompson, Jr., 92 N. Water St., Gallatin, Texas.

SIMMS MAGNETO, 4-cyl. type; 3 Model T Ford engines and some accessories: 5-tube Atwater-Kent battery radio; 8-tube Bremer-Tully Nameless battery radio; 5-tube All-American Super battery radio; 3-tube regenerative battery radio and some parts for the above radios. I will trade for a tachometer and cable, a vertical mounted magnetic compass and a temperature gauge.—LeRoy F. Wise, R. F. D. 2, Box 58, Aurora, Ill.

ELECTRIC MOTOR, light duty type, 6 in. circ. saw, 2 pairs of boxing gloves, set of McGregor golf clubs, back numbers of aero magazines, plans for all types of models, completed flying models. Will trade for a used motorcycle motor or any type of small engine. Will also consider aero publications or what have you?—Richard Moores, 4726 Gray Road, Cincinnati, Ohio.

KINNER ENGINE with front exhaust. Will trade it for a lightplane or might throw in some cash for something larger. Slightly cracked planes considered.—Walter Chappelle, Sisson Highway, Eden, N. Y.

SZEKELY ENGINE, 45 h.p. or a Salmson 40 h.p. engine wanted. Will trade an L4 Lawrence, 60 h.p., 3-cyl. air-cooled engine in A-1 shape.—C. W. Wilson, 113 No. 14th Ave., Hopewell, Va.

SMALL GASOLINE ENGINE WANTED, 3 to 4 h.p. Will trade a 4'-6" flying model.—Howard Moninger, 8019 Dorchester Ave., Chicago, Ill.

OX-5 ENGINE, turns 1,400 r.p.m., good condition, will trade for an air-cooled engine of 100 h.p. or less.—Frank Van Duzer, 1017 Porter St., Waukegan, Ill.

CONVERTED HARLEY ENGINE, 61 cu. in., complete with prop, 18 x 3 wheels with tires, lightplane wings of 25 ft. span. I want a primary glider in good condition or a Cleone engine complete with prop.—Hollis Button, Aberdeen, S. D.

INBOARD MARINE ENGINE WANTED, light weight, 10 to 25 h.p. Have a Heath B4 engine, new and complete with a hardwood prop.—H. E. Irens, Jr., French's, 117 Montgomery St., Montgomery, Ala.

LIGHTPLANE ENGINE, 25 h.p. air-cooled, 2-cyl. Cleone with dual ignition. Will trade and pay cash difference for Szekely, Salmson or any engine of 40 to 45 h.p.—Lester Pierce, 523 T St., Eureka, Calif.

USED OUTBOARD ENGINE WANTED, 24-32 h.p., in good condition. Will trade a fuselage, controls and tail assembly for a Russell light sportplane. I also have a Ranger bicycle, compressed air motor, air tank and other things to trade.—Roger M. Carroll, 710 Valley St., Maplewood, N. J.

TWIN OUTBOARD ENGINE WANTED, in good condition. Will exchange Boice-Crane 30 in. comb. wood and metal lathe with sand disc and accessories. Never used.—R. D. Springer, 500 W. Annapolis St., St. Paul, Minn.

LIGHTPLANE ENGINE WANTED, or conversion, that runs or that can be overhauled cheaply. I offer evergreens, fruit trees, etc., and will give or take difference.—Ozark Nursery, Rogers, Arkansas.

1928 HARLEY-DAVIDSON SINGLE, good condition and one single cyl. outboard engine to trade on an Aeronca, cracked up or otherwise.—L. T. Clemenson, c/o Associated Gas & Electric, Johnstown, Pa.

MOTORCYCLE ENGINE WANTED, propeller or other airplane parts. Have a bamboo fly-rod, reel and line. Also outdoor mags. and radio parts.—W. Knight, R. F. D. 2, Commanche, Texas.

MAYTAG ENGINE WANTED, also 4 airplane wheels and midget car axles. Will trade a good 30-30 army rifle, 5 boxes of bullets for the rifle, and if worth it, will throw in some cash.—Bobby Burkett, Box 344, Cisco, Texas.

LIGHTPLANE ENGINE WANTED. An Aeronca, Continental A-40, Lawrence, Szekely, or any other kind around 35 h.p. Must be in running condition. What do you want?—Harry Green ,Box 8, Honey Creek, Ind.

GLIDERS

GLIDER. Will trade the glider for a new 0.30 sporting rifle or will accept a used gun in good condition, with some cash. Glider is in New York City, but write to me.—Joe Sarchiapone, Camp 43, Clarkia, Idaho.

BIPLANE GLIDER, complete except for covering and rigging. Have everything but dope to complete the job. Will also trade part interest in a glider at Raleigh, N. C., Ident. 11543. Both are good trainers. Will trade for anything that I can use, such as aero supplies or boat. Will trade all or any part.—Clyde Strickland, E. Durham Station, Durham, N. C.

PRIMARY TRAINING GLIDER, uncovered. Will trade for a good midget car of at least 5 h.p., or what have you?—Loyal Corwin, 504 S. Nap St., Nappanee, Ind.

GLIDER WANTED. Primary or secondary type. I have a brand new 12 size, 17 jewel, $35 South Bend watch with knife and chain. Also have other fine new watches, Titus exerciser and course.—Manager Conoco Station, Endee, N. M.

GUNS — SPORTING GOODS

25-20 WINCHESTER RIFLE and four foot to eight foot props to trade for bandsaw, drill-press, tennis set, radio or what have you?—Clarence Holden, Jr., 800 Thrall St., Fort Worth, Texas.

0.22 RIFLE WANTED. Will trade 50 magazines and some books.—John Elliott, 547A Congress St., Portland, Ore.

MISCELLANEOUS

ROW-BOAT WANTED, with oars, a motorcycle, pony, horse, bicycle, bugle, snare drum, pigeons, saddle or what have you? I have many things to exchange.—David Smith, 40 Davison Ave., East Rockaway, N. Y.

GILBER ERECTOR SET WANTED, a No. A, 8 or 8½. Have small model planes to trade. State model wanted. I also have a 350 shot BB gun, foot-ball, volley-ball and crystal radio set.—George Malone, Jr., Olive, New Mexico.

FISHER BODY KIT and plans. Also a Chemcraft set. I am interested in radio and models. What have you?—Phillip Banks, Clark, S. D.

MODEL PLANS WANTED. I want all of Cleveland's ¾ in. flying scale model plans. Must be in good condition. Have a microscope, telescope, banjo-mandolin, etc. Send for my list and send yours.—M. J. O'Brien, Park Ave., Merrick, N .Y.

AQUARIUM, 4-gal., stamp album, magazines, 0.22 rifle, and many other things. What have you to swap for them?—Chuck Brehm, 405 Peach Orchard Ave., Dayton, Ohio.

SNAPSHOTS and newspaper clippings of the various planes used in the 1933 National Air Races, Chicago Air Races or any other races wanted. Have large 9 x 12 commercial photos and mags to trade. What have you?—Paul McCormick, 430 West Wildwood Ave., Wildwood, New Jersey.

AIRPLANE PICTURES WANTED. Modern planes preferred. I will have what you want in trade.—Jay Haynes, 172 West Cliff St., Somerville, N. J.

DRUM, a Ludwig Street Drum, snare head broken, for a good used motorcycle, motor or parts.—Lee Spencer, 621 N. 9th St., Fredonia, Kansas.

MOTORCYCLES

EVANS-MOTORBIKE in excellent condition and complete with parking stand, lights, license bracket, and Morrow coaster brake. Will consider motorcycle engine or what have you?—Eugene Irvin, Blanchester, Ohio.

MOTORCYCLE WANTED. Will trade a 32-20 cal. Marlin rifle for it, and will add cash if necessary.—Oswald Halverson, R. F. D. 1, Dodgeville, Wisconsin.

MOTORCYCLE WANTED. Any kind as long as it runs, but 1927-28 model preferred. Will trade zither and music, 3 bicycle frames and many other articles.—Kenn Wasson, Box 237, Franklin Grove, Ill.

1928 HARLEY-DAVIDSON, 74, also a Twin and a 4-cyl. engine of 7 h.p. (1911) Indian. I have windshield and other equipment for the Harley. Will trade for a 2-place Eaglet, Curtiss-Wright, Jr., Aeronca, with or without engine. What have you?—Otto A. Meyer, R. 4, Box 78, West Point, Nebr.

MOTORCYCLE WANTED, 1923-1924 model. Must be in good running condition, but tires are not necessary. A twin preferred. I have almost anything in the line of radio to trade, auto parts and a few motorcycle parts.—Harry Green, Box 8, Honey Creek, Ind.

OPTICAL GOODS

MOVING PICTURES, 7 reels, to trade for an accordion or radio parts. What have you?—Farl Goddard, Box 83, Mesilla Park, New Mexico.

MICROSCOPE, 60 power, a 0.22 single-shot Hamilton, 300 0.22 cartridges, small paint sprayer which attaches to an auto tire for pressure. Would like small kicker, bicycle, motorcycle engine or what have you along these lines?—Henry Odenwald, 19 Saddle River Road, Rochelle Park, N. J.

RADIO

TRANSMITTER, radiophone type, 7.5 watt, short-wave receivers and guns to trade for a lightplane or lightplane engine. What have you?—Raymond Reiter, 227A West, Kingman, Kansas.

AIR-KING super-het, 3-tube A. C. short-wave converter and book, Everybody's Aviation Guide by Page. Will trade for a set of Modern Aviation Engines by Page and the 1929-30-31-32 issues of the Flying Manual.—William Klecan, 575 Hunterdon St., Newark, N. J.

SHORT-WAVE RADIO, 3-tube. Will trade for one of the following. Typewriter, electric radio, outboard motor, 12 ga. Shotgun.—Robert Bentham, 15 Jackle Ave., Silver Creek, N. Y.

WORKSHOP SUPPLIES — TOOLS

METAL TURNING LATHE WANTED, not over 8 in. swing. Will trade guns, binoculars, slide-rule, drawing instruments, micrometers, electric motors, generators, neon transformer, portable elct. sewing machine, radio set tester, service equipment and parts. Write to: B. Speicher, 302 S. Wash. Ave., Jermyn, Pa.

HOME WORKSHOP EQUIPMENT WANTED. What have you? I will trade a bicycle, 0.22 cal. rifle, steam powered model boat, boys' books, ready-built model airplanes to trade.—Frank H. McLaughlin, 5238 Nottingham Ave., St. Louis, Mo.

Menace of Wires

(*Continued from page* 233)

The writer is of the belief that if a broad strip of cloth, conspicuously striped, were suspended along the tops of the poles near the airport, at least, this would be a most effective danger signal to the pilot. At night, this strip could be easily and cheaply illuminated by small inexpensive spot-lights so that the gaudy striped cloth would shine up as brightly at night as well as in the daytime. And tests show that these strips are quite visible on clear nights, with or without a moon.

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POPULAR AVIATION
608 S. Dearborn St.
Chicago, Ill.

Sammy Lee
(*Continued from page* 240)

But he gave me a shove and started walking toward the hangars. There was nothing to do but go. I swallowed my adams-apple, tried to recall a prayer to my ancestors' bones and shoved open the throttle. With the instructor out, the plane seemed to be much lighter. The motor roared back at me like a laughing demon. I pushed the stick as far as it would go, keeping the nose on the horizon with it. Suddenly the nose veered to the right! I brought it back by fanning the rudder.

So far, so good. It wouldn't be long now. Back, back, on the stick. I was off the ground. Could it be possible? I glanced down again. Flying . . . actually flying. Alone . . . SOLOING!

I made the turn and heroically decided to use the entire field for landing. I checked the wind, turned the plane into its landing path and sat tight.

I *knew* there was something else! I proceeded to check such small items as horizon-angles, air-speed, ground-speed, keeping the wings level, throttling the motor, and in fact doing such odd jobs as seemed needed doing. I actually *loved* Miss Quong at this time!

Never before had I so appreciated the presence of my dear instructor . . . how vacant his seat looked. And the earth came nearer and nearer, longed for but still not welcomed suddenly. One more appealing look at the instruments and then to make ready for almost anything.

I simply *adored* Miss Quong!

But now I was approaching where something had to be done quickly, something that I hoped would be right with all my heart.

At fifteen feet above the earth, I somehow found time from my duties to look up and level-off . . . a moment more! Was I an airman or a subject for the Chinatown undertaker?

The wheels touched the ground and "Up," bounced the wheels. Again they hit the ground, and again the bounce. Down they crashed!

"Whew!" Then they stay put. On and on I whirled.

After the plane had come to a writhing stop, which by the way, ended gracefully in a ground-loop, I couldn't supress the exuberance that surged up through my body. Grandfather's two hundred dollars had flown the coop, but I had flown, too!

"Boy! Did you see THAT landing?" I shouted to the four corners of America.

"Yeah, I saw the first three you . . . but after that I lost count you . . . !"

So let me, dear grandfather, please have more birthdays.

END.

Your flying career will depend on TRAINING

A TRAINING that does not bring to its student-flyers and mechanics aviation's full range of experience will fall short of the requirements — somewhere, sometime. In addition to teaching you how to fly, the Boeing School teaches you *all about it.*

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Aeronautics

***by* Hilton F. Lusk, *formerly Dean, Boeing School of Aeronautics. 175 illustrations.* $3.25.**

This is a complete ground school course in handy book form. It clearly and thoroughly explains all the subjects you need to understand to pass the written part of the government examination for a license as an airplane pilot in any of the grades—including transport pilot, or as an airplane or engine mechanic. No one who masters this book will have any difficulty in answering any question that may be asked in the license examination, yet it is written so simply that anyone can readily understand it. 224 questions like those asked in the official examinations help you test your grasp of each subject. If you are interested in aviation as a career but are uncertain which branch you want to enter, you will also be helped by a chapter listing and describing 125 occupations in the industry, with educational preparation recommended for each, rates of pay, etc.

Subjects covered include: Flight Principles; Airplane Construction, Operation; Engine Principles, Construction, Operation; Propellers; Attitude, Engine Instruments; Maps, Piloting; Dead Reckoning; Avigation Instruments, Equipment; Meteorology.

BECOME AN EXPERT PILOT MANY HOURS SOONER AND CUT THE COST OF YOUR FLIGHT TRAINING

Practical Flying

A Training Guide for Pilots

by Major B. Q. Jones

Air Corps, U. S. Army; formerly Chief of Aviation Training, A.E.F.

Reading this book is like having at your elbow the famous flyer who wrote it, ready to clear up quickly all the scores of questions that puzzle you as you progress to the skill of an expert pilot. It is the first book that the beginner ought to read before he even gets into an airplane. The most experienced pilot will find it filled with practical suggestions and explanations of vital value.

First, Major Jones outlines the physical and mental characteristics that you should possess if you wish to become a pilot. Then he describes all the parts of a plane, instruments, etc.; discusses maneuvers in the air; and explains technical expressions and slang terms.

From this he proceeds to clear and concise answers to the hundreds of questions that student pilots have asked for years—information that is essential for a proper understanding of piloting. For much of the detailed information, the explanations are provided in question and answer form. A wide range of practical subjects is covered, such as the most useful instruments for each class of flying, why a magnetic compass spins during fog-flying, "dead-stick" landings, taxying, straight-away flight, glides, turns, figures-of-eight, methods of plane inspection, testing controls and motor. Particularly important are his detailed explanations of the causes of crashes during take-off and turns for landing; how to recognize stalls in time and correct for them; how stalls progress into spins and how to get out of them easily.

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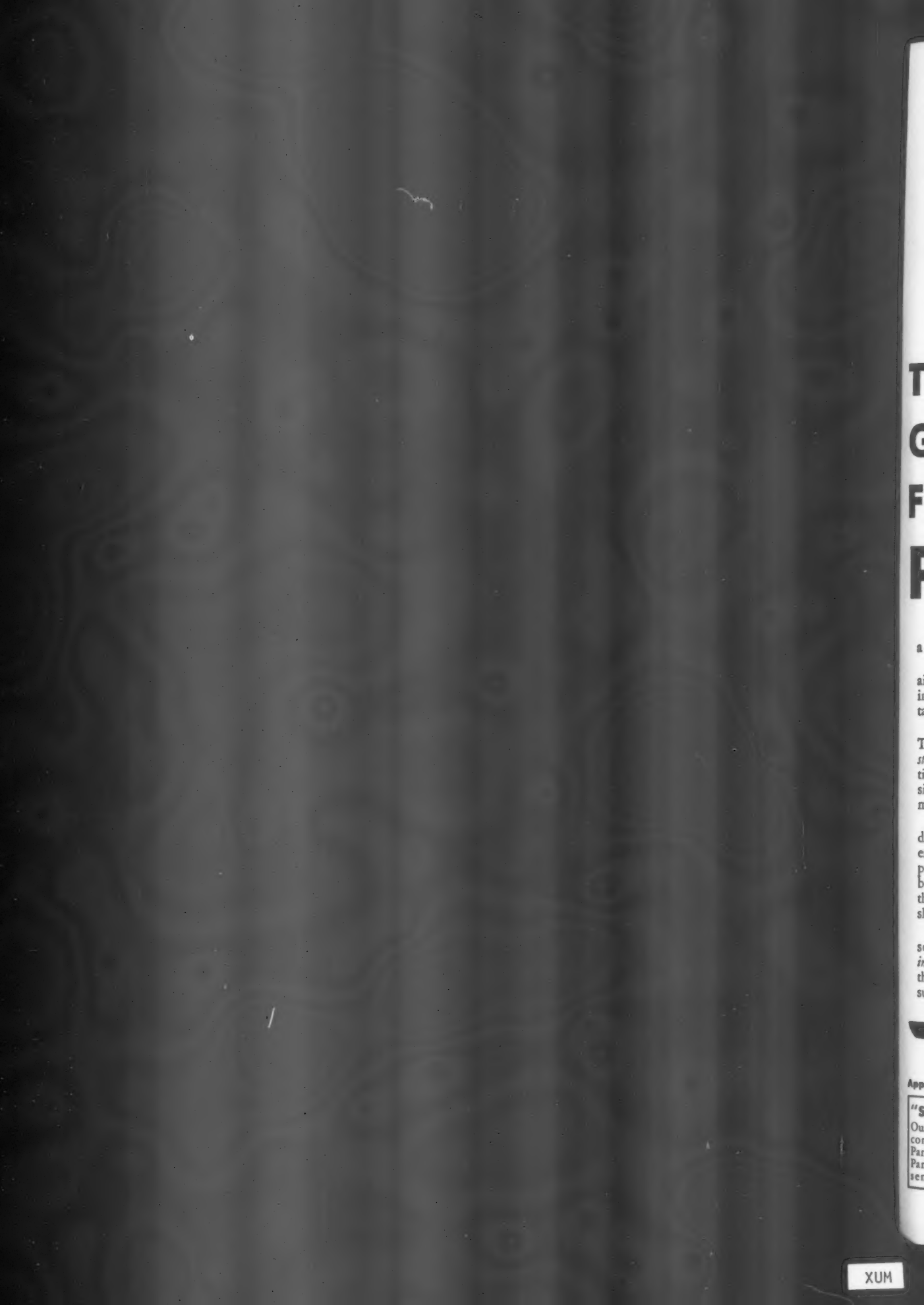

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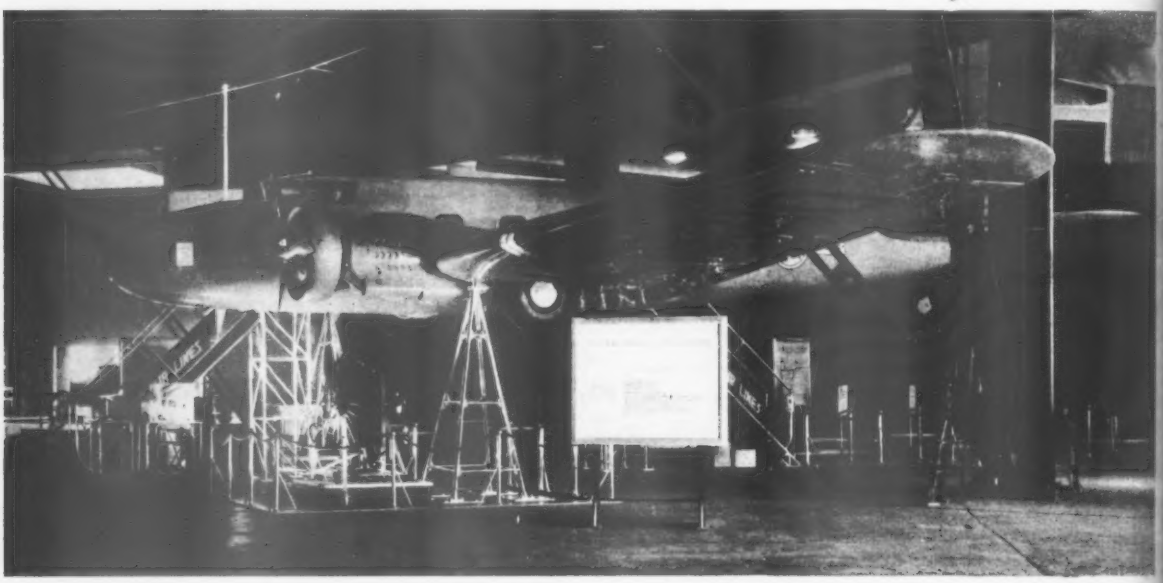

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